

Files from C:\RON\AUTOSPLT\INTENT\INTENT.ZIP

DRL\_CMDS.C96 08/29/94

PR\_S\_I\_S.C96 06/30/94

SEL\_GEAR.C96 08/19/94

SEQ\_SHFT.C96 08/04/94

TRNS\_ACT.C96 08/18/94

```

*****
*
*   Unpublished and confidential. Not to be reproduced,
*   disseminated, transferred or used without the prior
*   written consent of Eaton Corporation.
*
*   Copyright Eaton Corporation, 1993-94.
*   All rights reserved.
*
*****
*
*   Filename: etc_cmds.c9v (AutoSplit)
*
*   Description:
*   The functions in this file will perform the required operations
*   for controlling driveline components on the J1939 communication link.
*
*   Part Number: <none>
*
*   $Log: R:\ashift\wcs\drl_cmds.c9v $
*
*   Rev 1.9  25 Feb 1994 16:07:40  schroeder
*   Removed predip's (experimental) BIN 8 ramp off rate--no longer needed.
*   Added condition to predip's torque bumps: timers are frozen until
*   actual_engine_pct_trq responds. Important when engine brakes are on.
*   Made RECOVERY_STEP_TABLE[] a constant value--all ratios used 8%.
*
*   Rev 1.8  21 Feb 1994 15:07:26  schroeder
*   Replaced shiftability_mode with new flag, engine_brake_available.
*
*   Rev 1.7  03 Feb 1994 15:57:28  schroeder
*   Added setting of command_ETC1 to each command function, enabling
*   overspeed during control_engine_predip() and control_engine_sync() and
*   disabling overspeed during all others.
*
*   Rev 1.6  17 Nov 1993 09:50:10  amsallen
*   In the initiate function, net_engine_pct_trq was replaced with
*   act_engine_pct_trq since desired_engine_pct_trq values are in indicated
*   power not net_power. Also the sync_timer timeout was reduced to 100 for
*   down shifts and 200 for upshifts(1 second and 2 seconds) rather than 200
*   for all shifts. Also the delay at 0 torque after a time out was increase
*   from 150msec to 250 msec.
*
*   Rev 1.5  04 Nov 1993 09:16:08  schroeder
*   In RECOVERY_STEP_TABLE[], restored the value for sixth gear to 8%.
*
*   Rev 1.4  02 Nov 1993 09:40:06  schroeder
*   Replaced demand_engine_pct_trq with pct_demand_at_cur_sp. Engine
*   speed limit during torque limit operation changed from high idle to
*   8031 rpm, as suggested in J1939/71.
*
*   Rev 1.3  11 Oct 1993 14:22:40  schroeder
*   Removed cruise_control_active flag; replaced accel pedal with
*   demand_engine_pct_trq.
*
*   Rev 1.2  22 Sep 1993 10:48:22  amsallen
*   The function control_engine_sync was changed to resolve OR 3235ma08.deb,
*   clunky low throttle high range shifts. The engine target now moves above
*   sync when input_speed - sync < 40 rpm and transmission position = engaging
*   rather than just tp = engaging. See OR 3235ma08.deb for additional details.
*
*   Rev 1.1  01 Sep 1993 14:09:52  schroeder
*   In control_engine_sync, modified dither to insure that the engine
*   target stays below sync for a range shift. Also, the dither amount
*   increases from 35rpm to 100rpm, then repeats.
*
*   Rev 1.0  29 Jul 1993 16:40:40  schroeder
*   Initial revision.
*
*****/

/*****
*
*   Header files included.
*
*****/

#include <exec.h>          /* executive information */

```

```

#include <c_regs.h>          /* KX internal register definitions */
#include <wvlib.h>           /* contains common global defines */
#include "cont_sys.h"        /* control system information */
#include "conj1939.h"        /* defines interface to j1939 control module */
#include "drl_cmds.h"        /* driveline commands information */
#include "trn_tbl.h"         /* transmission table data structures */
#include "sel_gear.h"        /* access to speed filter values */
#include "calc_spd.h"
#include "trns_act.h"

#pragma noreentrant

/*****
 *
 * #defines local to this file.
 *
 *****/

#define US_PER_LOOP 10000U

#define ACTIVE_RECOVERY_GEAR 10 /* rule out boosting downs for now */

/*****
 *
 * Constants and variables declared by this file.
 *
 *****/

/* public */

register uchar engine_commands;
register uchar engine_status;
uchar desired_sync_test_mode;
/* uint desired_eng_spd_new; */
/* uint desired_eng_spd_delta; */
/* uint desired_eng_spd_diff; */
uint desired_engine_speed_test;
uint desired_engine_speed_ramp;
uchar desired_engine_speed_timer;
uchar desired_engine_speed_time;
uchar eng_brake_command;
uchar eng_brake_assist;
uchar positive_pedal_trans;
uchar sync_first_pass_timer;
uchar clutch_state;
uint clutch_slip_speed;
int dos_filtered;
int overall_error;
unsigned int os_based_on_rcs;
unsigned int input_speed_filtered;
unsigned long is_filtered_bin8;
unsigned int output_speed_filtered;
unsigned long os_filtered_bin8;
signed int input_speed_accel_filtered;
signed long dis_filtered_bin8;

char eng_percent_torque_filtered;
char percent_torque_accessories;
char needed_percent_for_zero_flywheel_trq;
uchar zero_flywheel_trq_timer;
uchar zero_flywheel_trq_time;
uchar accelerator_pedal_position_old;
int input_shaft_accel_calculated;
uint gos; /* overall destination gear ratio * output speed BIN 0 */
int gos_signed; /* overall destination gear ratio * output speed BIN 0 */

uint gos_current_gear; /* overall current gear ratio * output speed BIN 0 */

unsigned char sync_first_pass;
unsigned int sync_maintain_timer;
signed int sync_offset;
signed int sync_dos_offset;
signed int sync_dos_offset_K1;
signed int sync_speed_modified;
unsigned char intent_to_shift;
char intent_final_pct_trq;
char intent_ramp_off_rate;

/* local */

```

```
static uint predip_timer_1;  
static uchar predip_timer_2;  
static uchar predip_timer_3;  
static char predip_torque_bump_value;  
static uchar predip_torque_bump_time;
```

```
static uint sync_on_timer;  
static uint sync_off_timer;  
static uchar sync_dither_timer;
```

```
static uint torque_limit;  
static uchar recovery_cancel_timer;  
static uint recov_coast_down_tmp1;  
static uint recov_coast_down_tmp2;
```

```
static int dgos;  
static int lpf_output_accel;
```

```
#pragma EJECT
```

```

*****
*
*               PREDIP MODE CONSTANTS
*
*****/

#define PREDIP_ZERO_FDBK_TIME      40      /* 0.40s @10ms period */
#define PREDIP_TORQUE_ZERO_TIME    60      /* 0.60s @10ms period */
#define PREDIP_NORMAL_TIME        200     /* 2.00s @10ms period */
#define TORQUE_RAMP_OFF_RATE       1       /* 1% (per loop) */

#define PREDIP_TORQ_BUMP_VALUE_LO   0       /* 0% */
#define PREDIP_TORQ_BUMP_TIME_LO   15      /* 0.15s @10ms period */

#define PREDIP_TORQ_BUMP_VALUE_MED  5       /* 5% */
#define PREDIP_TORQ_BUMP_TIME_MED  25      /* 0.25s @10ms period */

#define PREDIP_TORQ_BUMP_VALUE_HI  10      /* 10% */
#define PREDIP_TORQ_BUMP_TIME_HI   30      /* 0.30s @10ms period */

/*****
*
*               SYNC MODE CONSTANTS
*
*****/

#define SYNC_DITHER_TIME_ABOVE    20      /* 0.20s @10ms period */
#define SYNC_DITHER_TIME_BELOW    30      /* 0.30s @10ms period */
#define SYNC_DITHER_RPM           35      /* 35 rpm */
#define SYNC_DITHER_FIRST_TIME    255     /* DUMMY VALUE */

#define MAINTAIN_SYNC_TIME         500     /* 5.00 Sec */
#define SYNC_FIRST_PASS_TIME       250     /* 2.50 Sec */
#define THREE_PERCENT              3
#define ENG_RESPONSE_UPSHF_TIME    10      /* 10 msec */
#define ENG_RESPONSE_DNSHF_TIME    10      /* 10 msec */
#define SYNC_DOS_OFFSET_CONSTANT   2816    /* 11 BIN 8 */

/*****
*
*               RECOVERY MODE CONSTANTS
*
*****/

#define RECOVERY_CANCEL_TIME        10      /* 0.10s @10ms period */
#define RECOVERY_CANCEL_OFFSET      20      /* 20% BIN 0 */
#define RECOVERY_TORQUE_STEP        1280    /* 5% BIN 8 */
#define THLO_DS_ENG_DECAY_K1        450
#define THLO_DS_ENG_DECAY_RAMP      1       /* 1 rpm BIN 0 */
#define THLO_DS_FINISHED_DELTA      200     /* 200 rpm BIN 0 */

static const uint RECOVERY_RATE_TABLE[23] =
(
0,      /* -4 */
0,      /* -3 */
128,    /* -2 : 0.50% per loop BIN 8 */
128,    /* -1 : 0.50% per loop BIN 8 */
128,    /* 0 : 0.50% per loop BIN 8 */
128,    /* 1 : 0.50% per loop BIN 8 */
128,    /* 2 : 0.50% per loop BIN 8 */
128,    /* 3 : 0.50% per loop BIN 8 */
128,    /* 4 : 0.50% per loop BIN 8 */
192,    /* 5 : 0.75% per loop BIN 8 */
192,    /* 6 : 0.75% per loop BIN 8 */
192,    /* 7 : 0.75% per loop BIN 8 */
281,    /* 8 : 1.10% per loop BIN 8 */
281,    /* 9 : 1.10% per loop BIN 8 */
281,    /* 10 : 1.10% per loop BIN 8 */
0,      /* 11 */
0,      /* 12 */
0,      /* 13 */
0,      /* 14 */
0,      /* 15 */
0,      /* 16 */
0,      /* 17 */
0       /* 18 */
);

```

#pragma EJECT

```

/*****
 *
 * Function: initialize_driveline_data
 *
 * Description:
 *   This function, called after all resets, will initialize the system
 *   copy of driveline related data received from the communications link.
 *
 *****/

```

```

static void initialize_driveline_data(void)
{
    accelerator_pedal_position = 0;
    engine_communication_active = FALSE;
    engine_brake_available = FALSE;
    eng_brake_command = ENG_BRAKE_IDLE; /* should init with engine_commands */
    clutch_state = ENGAGED;
    positive_pedal_trans = FALSE;
    zero_flywheel_trq_timer = 0;
    zero_flywheel_trq_time = 0;
    percent_torque_accessories = 3;

    desired_sync_test_mode = FALSE; /* debug use only - delete later */
    desired_engine_speed_test = 0; /* debug use only - delete later */
    desired_engine_speed_ramp = 0; /* debug use only - delete later */
    desired_engine_speed = 0;
    /* desired_eng_spd_new = 0; */
    /* desired_eng_spd_diff = 0; */
    /* desired_eng_spd_delta = 10; */
    desired_engine_speed_timer = 0;
    sync_dos_offset_K1 = SYNC_DOS_OFFSET_CONSTANT;
    desired_engine_speed_time = 0;
    intent_to_shift = FALSE;
    intent_final_pct_trq = 0;
    intent_ramp_off_rate = 1;
}

```

```

#pragma EJECT

```

```

/*****
 *
 * Function: control_engine_predip
 *
 * Description:
 *   Determines throttle command for predip mode.
 *
 *   After a reasonable delay for the transmission to pull to neutral the
 *   torque will be cycled from zero to a determined value to help the
 *   transmission achieve neutral.
 *
 *****/

static void control_engine_predip(void)
{
    if (engine_status != ENGINE_PREDIP_MODE)
    {
        engine_status = ENGINE_PREDIP_MODE;

        predip_timer_1 = 0;
        predip_timer_2 = 0;
        predip_timer_3 = 0;

        if (actual_engine_pct_trq < 5)
            predip_timer_1 = PREDIP_NORMAL_TIME;
        else
            desired_engine_pct_trq = actual_engine_pct_trq;
    }

    engine_control = TORQUE_CONTROL;
    command_ETC1 = C_ETC1_OVERSPEED;

    if (predip_timer_1 < PREDIP_NORMAL_TIME)
    {
        if ((desired_engine_pct_trq >= TORQUE_RAMP_OFF_RATE) &&
            (actual_engine_pct_trq > 0))
        {
            desired_engine_pct_trq -= TORQUE_RAMP_OFF_RATE;
        }
        else
        {
            desired_engine_pct_trq = 0;

            /* check to force bump if neutral not achieved */
            if (actual_engine_pct_trq < 10)
            {
                if (++predip_timer_3 >= PREDIP_ZERO_FDBK_TIME)
                    predip_timer_1 = PREDIP_NORMAL_TIME;
            }
        }
        ++predip_timer_1;
    }
    else
    {
        if ((lpf_output_accel > -150) &&
            (predip_timer_1 < (PREDIP_NORMAL_TIME + PREDIP_TORQUE_ZERO_TIME)))
        {
            predip_torque_bump_time = PREDIP_TORQ_BUMP_TIME_LO;
            predip_torque_bump_value = PREDIP_TORQ_BUMP_VALUE_LO + needed_percent_for_zero_flywheel_trq;
        }
        else
        {
            if (predip_timer_1 < (PREDIP_NORMAL_TIME + 2*PREDIP_TORQUE_ZERO_TIME))
            {
                predip_torque_bump_time = PREDIP_TORQ_BUMP_TIME_MED;
                predip_torque_bump_value = PREDIP_TORQ_BUMP_VALUE_MED + needed_percent_for_zero_flywheel_trq;
            }
            else
            {
                predip_torque_bump_time = PREDIP_TORQ_BUMP_TIME_HI;
                predip_torque_bump_value = PREDIP_TORQ_BUMP_VALUE_HI + needed_percent_for_zero_flywheel_trq;
            }
        }

        if (predip_timer_2 < predip_torque_bump_time)
        {
            desired_engine_pct_trq = predip_torque_bump_value;
            if (actual_engine_pct_trq > 0)
            {

```



```

        ++predip_timer_1;
        ++predip_timer_2;
    )
}
else
{
    desired_engine_pct_trq = 0;
    ++predip_timer_1;
    ++predip_timer_2;
}

if (predip_timer_2 >= PREDIP_TORQUE_ZERO_TIME)
    predip_timer_2 = 0;
}
#pragma EJECT

```

```

/*****
 *
 * Function: control_engine_sync_lever (AutoSplit)
 *
 * Description:
 * This function synchronizes engine speed to output shaft speed
 * during a shift.
 *
 *****/

static void control_engine_sync_lever(void)
(
    if (accelerator_pedal_position > THREE_PERCENT)
        sync_maintain_timer = MAINTAIN_SYNC_TIME;

    if ((engine_status != ENGINE_SYNC_MODE) || (sync_maintain_timer == 0))
    (
        sync_on_timer = 0;
        sync_off_timer = 0;

        if (engine_status != ENGINE_SYNC_MODE) /* first time through sync */
        (
            sync_maintain_timer = MAINTAIN_SYNC_TIME;
            engine_status = ENGINE_SYNC_MODE;
        )
        else /* sync_maintain_timer reached 0 */
        (
            engine_control = OVERRIDE_DISABLED;
            command_ETC1 = C_ETC1_NORMAL;
        )
    )

    else
    (
        sync_maintain_timer--;

        if (sync_on_timer++ <= 296) /* allow sync mode for about 3 SEC */
        (
            sync_off_timer = 0;
            engine_control = SPEED_CONTROL;
            command_ETC1 = C_ETC1_OVERSPEED;

            if (shift_type == UPSHIFT)
            (
                sync_offset = -65; /* RPM */
            )

            else /* shift is a downshift */
            (
                sync_offset = -65; /* RPM */
            )

            if (gos_signed + sync_offset > 0)
            (
                /* desired_engine_speed = (int)(gos_signed + sync_offset); */

                _cx = dos_filtered; /* BIN 0 */
                _bx = trn_tbl.gear_ratio[destination_gear + GR_OFS]; /* BIN 8 */
                _ax = sync_dos_offset_K1; /* BIN 8 */
                asm mul _cxdx, _bx; /* BIN 8 */
                asm div _cxdx, _ax; /* divide by constant BIN 8 */
                sync_dos_offset = _cx; /* save final result BIN 0 */

                desired_engine_speed = (int)(gos_signed + sync_offset + sync_dos_offset);
            )

            #if (0)
                desired_eng_spd_new = (int)(gos_signed + sync_offset);

                if (desired_eng_spd_new > desired_engine_speed)
                    desired_eng_spd_diff = desired_eng_spd_new - desired_engine_speed;
                else
                    desired_eng_spd_diff = desired_engine_speed - desired_eng_spd_new;

                if (desired_eng_spd_diff > desired_eng_spd_delta)
                    desired_engine_speed = desired_eng_spd_new;
            #endif
        )
    )
}

```

```

    )
    else
        desired_engine_speed = 0;
    }
    else
    {
        if (sync_off_timer <= 4)
        {
            sync_off_timer++;
        }
        #if (0)
            engine_control = TORQUE_CONTROL;
            command_ETC1 = C_ETC1_OVERSPEED;
            desired_engine_pct_trq = needed_percent_for_zero_flywheel_trq;
        #endif
    }
    else
        sync_on_timer = 0;
}
}
}

#pragma EJECT

```

```

/*****
 *
 * Function: control_engine_sync_auto (AutoSplit)
 *
 * Description:
 * This function synchronizes engine speed to output shaft speed
 * during a shift.
 *****/

static void control_engine_sync_auto(void)
(
    if (accelerator_pedal_position > THREE_PERCENT)
        sync_maintain_timer = MAINTAIN_SYNC_TIME;

    if ((engine_status != ENGINE_SYNC_MODE) || (sync_maintain_timer == 0))
    (
        sync_on_timer = 0;
        sync_off_timer = 0;
        sync_first_pass = TRUE;
        sync_first_pass_timer = SYNC_FIRST_PASS_TIME;

        if (shift_type == UPSHIFT)
            sync_offset = -65;
        else
            sync_offset = 65;

        if (engine_status != ENGINE_SYNC_MODE) /* first time through sync */
        (
            sync_maintain_timer = MAINTAIN_SYNC_TIME;
            engine_status = ENGINE_SYNC_MODE;
        )
        else /* sync_maintain_timer reached 0 */
        (
            engine_control = OVERRIDE_DISABLED;
            command_ETC1 = C_ETC1_NORMAL;
        )
    )

    else
    (
        sync_maintain_timer--;

        if (sync_on_timer++ <= 200) /* allow sync mode for about 2 seconds */
        (
            sync_off_timer = 0;
            engine_control = SPEED_CONTROL;
            command_ETC1 = C_ETC1_OVERSPEED;

            if (sync_first_pass == TRUE)
            (
                if (shift_type == UPSHIFT)
                (
                    sync_speed_modified = (signed int)(input_speed) +
                        (input_speed_accel_filtered / (1000/ENG_RESPONSE_UPSHF_TIME));

                    if (sync_speed_modified < gos_signed)
                    (
                        if (sync_first_pass_timer == 0)
                        (
                            sync_offset = 65;
                            sync_first_pass = FALSE;
                        )
                        else
                            sync_first_pass_timer--;
                    )
                )
                else /* shift is a downshift */
                (
                    sync_speed_modified = (signed int)(input_speed) +
                        (input_speed_accel_filtered / (1000/ENG_RESPONSE_DNSHF_TIME));

                    if (sync_speed_modified > gos_signed)
                    (
                        /* if (sync_first_pass_timer == 0) */
                        /* { */
                        sync_first_pass = FALSE;
                        if (pct_demand_at_cur_sp < 15)
                            sync_offset = -65;
                    )
                )
            )
        )
    )
)

```

```

/* */
/* else */
/* sync_first_pass_timer--; */
}
)
)

if (gos_signed + sync_offset > 0)
    desired_engine_speed = (int)(gos_signed + sync_offset);
else
    desired_engine_speed = 0;
}
else
(
    if (sync_off_timer <= 4)
    (
        sync_off_timer++;
#ifdef (0)
        engine_control = TORQUE_CONTROL;
        command_ETC1 = C_ETC1_OVERSPEED;
        desired_engine_pct_trq = needed_percent_for_zero_flywheel_trq;
#endif
    )
    else
    (
        sync_on_timer = 0;
        sync_offset = -(sync_offset); /* force sync speed to toggle around gos */
    )
)
)
)
#pragma EJECT

```

```

/*****
*
* Function: control_engine_sync    (AutoSplit)
*
* Description:
*   This function synchronizes engine speed to output shaft speed
*   during a shift.
*
*****/

```

```
static void control_engine_sync(void)
```

```
{
    if (shift_init_type == AUTO)
        control_engine_sync_auto();
    else
        control_engine_sync_lever();

    intent_to_shift = FALSE;

```

```
}
```

```
#pragma EJECT
```

```

/*****
 *
 * Function: control_engine_sync_test_mode (AutoSplit)
 *
 * Descriptions
 * This function test the synchronize mode of engine speed control.
 *
 *****/

static void control_engine_sync_test_mode(void)
(
    if (accelerator_pedal_position < 10)
    (
        engine_status = ENGINE_FOLLOWER_MODE;
        engine_commands = ENGINE_FOLLOWER;
        engine_control = OVERRIDE_DISABLED;
        command_ETC1 = C_ETC1_NORMAL;
        desired_engine_speed = 0;
    )
    else
    (
        if (accelerator_pedal_position > 90)
        (
            engine_status = ENGINE_SYNC_MODE;
            engine_commands = ENGINE_SYNC;
            engine_control = SPEED_CONTROL;
            command_ETC1 = C_ETC1_OVERSPEED;
            desired_engine_speed = desired_engine_speed_test;
            desired_engine_speed_timer = desired_engine_speed_time;
        )
        else
        (
            if (desired_engine_speed_timer > 0)
                desired_engine_speed_timer--;
            else
            (
                if (desired_engine_speed > 600)
                (
                    desired_engine_speed_timer = desired_engine_speed_time;
                    desired_engine_speed = (desired_engine_speed - desired_engine_speed_ramp);
                )
            )
        )
    )
)
#pragma EJECT

```

```

*****
*
* Function:  determine_if_recovery_complete
*
* Description:
*   This routine checks to see if the percent_torque_value_limit has
*   exceeded the percent_torque_value feedback from the engine by x%
*   for x milliseconds and will then set percent_torque_value_limit
*   to 100% to cancel the recovery mode.
*
*****/

static void determine_if_recovery_complete(void)
(
    if ((net_engine_pct_trq > 10) &&
        (desired_engine_pct_trq > (net_engine_pct_trq + RECOVERY_CANCEL_OFFSET)))
    (
        ++recovery_cancel_timer;
    )
    else
        recovery_cancel_timer = 0;

    if ( (recovery_cancel_timer >= RECOVERY_CANCEL_TIME) ||
        (desired_engine_pct_trq == 100) )
    (
        /* terminate the recovery mode */
        desired_engine_pct_trq = 100;
        engine_status = ENGINE_RECOVERY_MODE_COMPLETE;
    )
)

#pragma EJECT

```



```

/*****
*
* Function: control_engine_recovery_normal
*
* Description:
*   Determine throttle command for recovery mode.
*   TORQUE_LIMIT is scaled as a BIN 8 number representing the percentage
*   of torque allowed to the engine during recovery.
*
*****/

static void control_engine_recovery_normal(void)
{
    engine_control = SPEED_TORQUE_LIMIT;
    command_ETC1 = C_ETC1_NORMAL;

    desired_engine_speed = 8031; /* torque limit only, max value for speed */

    torque_limit += RECOVERY_RATE_TABLE[destination_gear+4]; /* BIN 8 */

    desired_engine_pct_trq = (char)(torque_limit >> 8); /* BIN 0 */

    determine_if_recovery_complete();
}

#pragma EJECT

```

```

*****
*
* Function: control_engine_recovery_coasting
*
* Description:
*   Determine throttle command for coasting down shifts mode.
*
*****/

```

```

static void control_engine_recovery_coasting(void)
(
    register uint local_uint;

    if (sync_on_timer <= 300)
    (
        ++sync_on_timer;

        engine_control = SPEED_CONTROL;
        command_ETC1 = C_ETC1_NORMAL;

        sync_off_timer = 0;

        /** recov_coast_down_tmp1 = gos + (dgos * K1) - THLO_DS_ENG_DECAY_RAMP **/

        if (dgos < 0)          /* get absolute value */
            _cx = (uint)-dgos;
        else
            _cx = (uint)dgos;

        asm mulu _cxdx, #THLO_DS_ENG_DECAY_K1;    /* BIN 12 */
        asm shrl _cxdx, #12;                      /* BIN 0 */

        if (_cxdx > 500)                /* error check */
            local_uint = 0;
        else
            local_uint = _cx;

        if (lpf_output_accel > 0)
            recov_coast_down_tmp1 = (gos + local_uint) - THLO_DS_ENG_DECAY_RAMP;
        else
            recov_coast_down_tmp1 = (gos - local_uint) - THLO_DS_ENG_DECAY_RAMP;

        /** recov_coast_down_tmp2 = desired_engine_speed - THLO_DS_ENG_DECAY_RAMP **/

        recov_coast_down_tmp2 = desired_engine_speed - THLO_DS_ENG_DECAY_RAMP;

        if (recov_coast_down_tmp1 < recov_coast_down_tmp2)
            desired_engine_speed = recov_coast_down_tmp1;
        else
            desired_engine_speed = recov_coast_down_tmp2;
    )
    else
    (
        if (sync_off_timer <= 5)
        (
            ++sync_off_timer;
            engine_control = TORQUE_CONTROL;
            command_ETC1 = C_ETC1_NORMAL;
            desired_engine_pct_trq = 0;
        )
        else
            sync_on_timer = 0;
    )

    if ((desired_engine_speed + THLO_DS_FINISHED_DELTA) < gos)
    (
        /* terminate the recovery mode */
        desired_engine_pct_trq = 100;
        engine_status = ENGINE_RECOVERY_MODE_COMPLETE;
    )
)

```

```

#pragma EJECT

```

```

/*****
 *
 * Function: control_engine_recovery
 *
 * Description:
 *   This function determines which type of throttle recovery should be
 *   used. And initializes some of the variables that will be used.
 *
 *****/

static void control_engine_recovery(void)
(
    if ((engine_status != ENGINE_RECOVERY_MODE) &&
        (engine_status != ENGINE_RECOVERY_MODE_COMPLETE))
    (
        engine_status = ENGINE_RECOVERY_MODE;
        desired_engine_pct_trq = 0;
        recovery_cancel_timer = 0;
        sync_on_timer = 0;
        sync_off_timer = 0;

        /* kill pedal transition stuff */
        positive_pedal_trans = FALSE;
        positive_pedal_trans = FALSE;
        zero_flywheel_trq_timer = 0;
        zero_flywheel_trq_time = 0;

        if (gos < desired_engine_speed)
            desired_engine_speed = gos;

        /* set initial starting torque limit */ /* percent, BIN 8 */
        if ((actual_engine_pct_trq > needed_percent_for_zero_flywheel_trq) &&
            (pct_demand_at_cur_sp > 5))
            torque_limit = ((unsigned int)(actual_engine_pct_trq))<<8; /* percent, BIN 8 */
        else
            torque_limit = ((unsigned int)(needed_percent_for_zero_flywheel_trq))<<8; /* percent, BIN 8 */
    )

    if ((destination_gear > ACTIVE_RECOVERY_GEAR) &&
        (pct_demand_at_cur_sp < 5) &&
        ((shift_type == COAST_DOWN_SHIFT) ||
         (shift_type == UPSHIFT)))
    (
        control_engine_recovery_coasting();
    )
    else
    (
        control_engine_recovery_normal();
    )
)

#pragma EJECT

```

```

/*****
 *
 * Function: control_intent_to_shift
 *
 * Description:
 *   This function
 *
 *****/

```

```

static void control_intent_to_shift(void)
{
    if (engine_control != TORQUE_CONTROL)
    {
        desired_engine_pct_trq = actual_engine_pct_trq;
    }

    engine_control = TORQUE_CONTROL;
    command_ETC1 = C_ETC1_OVERSPEED;

    positive_pedal_trans = TRUE; /* allow for recovery mode */

    if ((desired_engine_pct_trq >= intent_ramp_off_rate) &&
        (actual_engine_pct_trq > intent_final_pct_trq))
    {
        desired_engine_pct_trq -= intent_ramp_off_rate;
    }
    else
    {
        desired_engine_pct_trq = intent_final_pct_trq;
    }
}

#pragma EJECT

```

```

/*****
 *
 * Function: control_engine_follower
 *
 * Description:
 *   This function sets the override_control_mode to no over ride so that
 *   the engine follows the accelerator demand.
 *
 *****/

static void control_engine_follower(void)
(
#define POSITIVE_PEDAL_TRANSITION_TIME    25 /* 250 MSEC */
#define NEGATIVE_PEDAL_TRANSITION_TIME    40 /* 400 MSEC */

    engine_status = ENGINE_FOLLOWER_MODE;

    if ((intent_to_shift == TRUE) &&
        (shift_in_process == FALSE) &&
        (desired_gear != destination_gear_selected))
    (
        control_intent_to_shift();
    )

    else
    (
        if ((accelerator_pedal_position >= 5) && /* positive pedal transition */
            (accelerator_pedal_position_old <= 4) &&
            (low_speed_latch == FALSE))
        (
            positive_pedal_trans = TRUE;
            zero_flywheel_trq_time = POSITIVE_PEDAL_TRANSITION_TIME;
            if (zero_flywheel_trq_timer >= NEGATIVE_PEDAL_TRANSITION_TIME)
                zero_flywheel_trq_timer = 0;
        )

        else
        (
            if ((accelerator_pedal_position <= 4) && /* negative pedal transition */
                (accelerator_pedal_position_old >= 5) &&
                (low_speed_latch == FALSE))
            (
                zero_flywheel_trq_time = NEGATIVE_PEDAL_TRANSITION_TIME;
                zero_flywheel_trq_timer = 0;
            )
        )

        if ((zero_flywheel_trq_timer < zero_flywheel_trq_time) &&
            (current_gear > 1) && (current_gear < 10) && (low_speed_latch == FALSE))
        (
            engine_control = TORQUE_CONTROL;
            command_ETC1 = C_ETC1_OVERSPEED;
            desired_engine_pct_trq = needed_percent_for_zero_flywheel_trq;

            if (actual_engine_pct_trq < (needed_percent_for_zero_flywheel_trq + 5));
                zero_flywheel_trq_timer++;
        )

        else
        (
            if ((positive_pedal_trans == TRUE) && (low_speed_latch == FALSE))
            (
                positive_pedal_trans = FALSE;
                engine_commands = ENGINE_RECOVERY; /* engine: finish torque return */
                control_engine_recovery();
            )

            else
            (
                engine_control = OVERRIDE_DISABLED;
                command_ETC1 = C_ETC1_NORMAL;
            )
        )
    ) /* end no intent_to_shift */
)
#pragma EJECT

```

```
/*
 * Function: control_engine_idle
 *
 * Description:
 *   This function sets the engine controls for the idle mode.
 *
 */
```

```
static void control_engine_idle(void)
{
    engine_control = OVERRIDE_DISABLED;
    command_ETC1 = C_ETC1_NORMAL;

    engine_status = ENGINE_IDLE_MODE;
}
```

```
#pragma EJECT
```

```
.....  
*  
* Function: control_engine_start  
*  
* Description:  
*   This function sets the engine controls for the start mode.  
*  
...../
```

```
static void control_engine_start(void)  
{  
    engine_control = OVERRIDE_DISABLED;  
    command_ETC1 = C_ETC1_NORMAL;  
  
    engine_status = ENGINE_START_MODE;  
}
```

```
#pragma EJECT
```

```

/*****
 *
 * Function: control_engine_compression_brake
 *
 * Description:
 *   This function controls the state of the engine compression brake.
 *   The brake can be used during upshifts to speed up the decel rate of
 *   the input shaft.
 *****/

```

```

static void control_engine_compression_brake(void)
{
    if (engine_communication_active &&
        (engine_status == ENGINE_SYNC_MODE) &&
        (shift_type == UPSHIFT) &&
        (input_speed_filtered > (gos + 150)) &&
        (destination_gear > 1) &&
        (destination_gear < 7) &&
        (engine_brake_available) &&
        ((dos_predicted < dos_prdtd_lim_no_jake) || eng_brake_assist))
    {
        eng_brake_assist = TRUE;
    }
    else
    {
        eng_brake_assist = FALSE;
    }

    eng_brake_assist = FALSE; /* force false state for now */
}

```

```

#pragma EJECT

```



```

/*****
 *
 * Function: determine_gos
 *
 * Description:
 *   This function multiplies the destination gear ratio times the
 *   output shaft speed for use in the DRL_CMDS module.
 *
 *   gos = (g)ear * (o)utput (s)peed
 *
 *****/

static void determine_gos(void)
(
    /*** determine gos for the destination_gear ***/
    _bx = trn_tbl.gear_ratio[destination_gear + GR_OFS];
    _cx = output_speed_filtered; /* output speed */
    asm mulu _cxdx, _bx;          /* BIN 8 result */
    asm shrl _cxdx, #8;           /* make BIN 0 */
    gos = _cx;                    /* BIN 0 */

    _cx = *(uint *)&lpf_output_accel;
    asm mul _cxdx, _bx;
    asm div _cxdx, #256;
    dgos = *(int *)&_cx;

    gos_signed = (signed int)(gos); /* allow signed math in other functions*/

    /*** determine gos for the "current_gear" ***/
    _bx = trn_tbl.gear_ratio[current_gear + GR_OFS];
    _cx = output_speed_filtered; /* output speed */
    asm mulu _cxdx, _bx;          /* BIN 8 result */
    asm shrl _cxdx, #8;           /* make BIN 0 */
    gos_current_gear = _cx;       /* BIN 0 */

)

#pragma EJECT

```

```

/*****
 *
 * Function:  determine_shiftability_variables
 *
 * Description:
 * This function filters both the output speed and the rate of change of
 * the output speed for use in the shiftability function. This function
 * also calculates the rate of change of the input shaft based on the
 * filtered value for the rate of change of the output shaft.
 *
 * The filters used in this function are required to get a high level of
 * stability. The BIN 8 filter used here will provide a much smoother
 * output which is needed to filter out driveline oscillations.
 *
 * Note: These calculations were placed in this module because it is
 * called on a regular 10 msec interval. These calculations should
 * be placed in the pr_i_s_i.c96 module once shiftability is proven.
 * These variables are used in the SEL_GEAR.C96 module.
 *****/

static void determine_shiftability_variables(void)
(
    /* LPF coefficients: exp(-wT), T=0.010s */
    #define OS_LPF      248      /* 0.9691 BIN 8 (0.50Hz) */
    #define DOSFK1      249      /* 0.9727 BIN 8 (0.44Hz) */
    #define EPTFK1      252      /* 0.9844 BIN 8 (0.25Hz) */

    #define IS_FK1      236      /* 0.9219 BIN 8 (0.??Hz) */
    #define OS_FK1      236      /* 0.9219 BIN 8 (0.??Hz) */
    #define DISFK1      236      /* 0.9219 BIN 8 (0.??Hz) */

    #define LOW_RANGE   3197     /* 3.1224 BIN 10 */
    #define BIN_10      1024

    static long dos_filtered_bin8;
    static int ept_filtered_bin8;

    unsigned long is_filtered_partial_1;
    unsigned long is_filtered_partial_2;
    unsigned long os_filtered_partial_1;
    unsigned long os_filtered_partial_2;

    /** create lpf_output_accel */

    _bx = *(uint *)&output_speed_accel;          /* _bx = x(n), BIN 0 */
    _cx = *(uint *)&lpf_output_accel - _bx;        /* _cx = y(n-1) - x(n), BIN 0 */
    asm mul _cxdx, #OS_LPF;                        /* _cxdx = K*(...), BIN 8 */
    asm div _cxdx, #256;                            /* make BIN 0 */
    _bx += _cx;                                     /* _bx = x(n) + K*(...), BIN 0 */
    lpf_output_accel = *(int *)&_bx;                /* save acceleration */

    /** dos_filtered = (dos_filtered * DOSFK1) + (lpf_output_accel * (1-DOSFK1)) */

    _cxdx = *(ulong *)&dos_filtered_bin8;          /* BIN 8 */
    asm shral _cxdx, #2;                            /* BIN 6 (_cx) */
    asm mul _cxdx, #DOSFK1;                          /* BIN 14 */
    asm shral _cxdx, #6;                             /* BIN 8 */
    dos_filtered_bin8 = *(long *)&_cxdx;            /* save partial result */

    _cx = *(uint *)&lpf_output_accel;              /* BIN 0 */
    _bx = 256 - DOSFK1;                             /* 1 BIN 8 - DOSFK1 */
    asm mul _cxdx, _bx;                             /* BIN 8 */
    dos_filtered_bin8 += *(long *)&_cxdx;           /* sum is final result */

    dos_filtered = (int)(dos_filtered_bin8 >> 8); /* BIN 0 */

    /** eng_percent_torque_filtered = (eng_percent_torque_filtered * EPTFK1) +
    (net_engine_pct_trq * (1-EPTFK1)) */

    _cx = *(uint *)&ept_filtered_bin8;              /* BIN 8 */
    asm mul _cxdx, #EPTFK1;                          /* BIN 16 */
    asm shral _cxdx, #8;                             /* BIN 8 */
    ept_filtered_bin8 = *(int *)&_cx;                /* save partial result */

    _cx = net_engine_pct_trq;                        /* BIN 0 */
    _bx = 256 - EPTFK1;                             /* 1 BIN 8 - EPTFK1 */
    asm mul _cxdx, _bx;                             /* BIN 8 */
    ept_filtered_bin8 += *(int *)&_cx;                /* sum is final result */

```

```

eng_percent_torque_filtered = (char)(ept_filtered_bin8 >> 8);

/** input_shaft_accel_calculated = dos_filtered * gear_ratio */

_cx = trn_tbl.gear_ratio[destination_gear + GR_OFS]; /* BIN 8 */
_bx = *(uint *)&dos_filtered; /* BIN 0 */
asm mul _cxdx, _bx; /* BIN 8 */
asm shrl _cxdx, #8; /* BIN 0 */
input_shaft_accel_calculated = *(int *)&_cx;

/** calculate filtered input and output shaft speeds for AutoSplit */

/** determine os_based_on_rcs variable */
if (output_speed < 1000)
{
    _bx = aux_speed; /* BIN 0 */
    _cx = BIN_10; /* BIN 10 */
    _ax = LOW_RANGE; /* BIN 10 */
    asm mulu _cxdx, _bx; /* make aux_speed BIN 10 */
    asm divu _cxdx, _ax; /* divide by low range BIN 10 */
    os_based_on_rcs = _cx; /* BIN 0 */
}

/** input_speed_filtered = (input_speed_filtered * IS_FK1) +
    (input_speed * (1-IS_FK1)) */

_ax = (is_filtered_bin8 >> 4); /* BIN 4 */
_cx = IS_FK1; /* BIN 8 */
asm mulu _axbx, _cx; /* BIN 12 */
asm shrl _axbx, #4; /* BIN 8 */
is_filtered_partial_1 = _axbx; /* BIN 8 */

_cx = input_speed; /* BIN 0 */
_ax = 256 - IS_FK1; /* 1 BIN 8 - IS_FK1 */
asm mulu _axbx, _cx; /* BIN 8 */
is_filtered_partial_2 = _axbx; /* BIN 8 */

is_filtered_bin8 = is_filtered_partial_1 + is_filtered_partial_2;

input_speed_filtered = (unsigned int)(is_filtered_bin8 >> 8); /* BIN 0 */

/** output_speed_filtered = (output_speed_filtered * OS_FK1) +
    (output_speed * (1-OS_FK1)) */

_ax = (os_filtered_bin8 >> 4); /* BIN 4 */
_cx = OS_FK1; /* BIN 8 */
asm mulu _axbx, _cx; /* BIN 12 */
asm shrl _axbx, #4; /* BIN 8 */
os_filtered_partial_1 = _axbx; /* BIN 8 */

if (output_speed < 250)
    _cx = os_based_on_rcs; /* BIN 0 */
else
    _cx = output_speed; /* BIN 0 */

_ax = 256 - OS_FK1; /* 1 BIN 8 - OS_FK1 */
asm mulu _axbx, _cx; /* BIN 8 */
os_filtered_partial_2 = _axbx; /* BIN 8 */

os_filtered_bin8 = os_filtered_partial_1 + os_filtered_partial_2;

output_speed_filtered = (unsigned int)(os_filtered_bin8 >> 8); /* BIN 0 */

/** input_speed_accel_filtered = (input_speed_accel_filtered * DISFK1) + (input_shaft_accel * (1-DISFK1)) */

_cxdx = *(ulong *)&dis_filtered_bin8; /* BIN 8 */
asm shrl _cxdx, #4; /* BIN 4 (_cx) */
asm mul _cxdx, #DISFK1; /* BIN 12 */
asm shrl _cxdx, #4; /* BIN 8 */
dis_filtered_bin8 = *(long *)&_cxdx; /* save partial result */

_cx = *(uint *)&input_speed_accel; /* BIN 0 */
_bx = 256 - DISFK1; /* 1 BIN 8 - DISFK1 */
asm mul _cxdx, _bx; /* BIN 8 */
dis_filtered_bin8 += *(long *)&_cxdx; /* sum is final result */

input_speed_accel_filtered = (int)(dis_filtered_bin8 >> 8); /* BIN 0 */

```

```

/** determine state of clutch **/
if (engine_speed > input_speed)
    clutch_slip_speed = engine_speed - input_speed;
else
    clutch_slip_speed = input_speed - engine_speed;

if (clutch_slip_speed > 200)
    clutch_state = DISENGAGED;
else
    if ((engine_speed > 800) && (low_speed_latch == FALSE))
        clutch_state = ENGAGED;

/** determine desired percent torque needed for zero torque at flywheel **/
#if (0)
    if ((accelerator_pedal_position < 2) &&
        (clutch_state == ENGAGED) &&
        (current_gear == 0) &&
        (input_speed_filtered < 1100) &&
        (((engine_control == OVERRIDE_DISABLED) &&
          (low_speed_latch == FALSE) && (current_gear == 0)) ||
         (output_speed_filtered < 20)))
        percent_torque_accessories = eng_percent_torque_filtered; /* get at idle */
#endif
    percent_torque_accessories = 3; /* force value for now */

    needed_percent_for_zero_flywheel_trq = percent_torque_accessories +
        nominal_friction_pct_trq;

    overall_error = ((signed int)(input_speed_filtered) - (signed int)(gos));
}

```

engine  
speed

calc.  
for zero  
torque  
per-motor

#pragma EJECT

$$\text{flywheel torque} = \text{gross engine torque} - \left( \text{base torque} + \text{engine torque} \right)$$

Equivalent to cal. 4.103 at 1477

friction  
at fly  
engine

```

/*****
 *
 * Function: communicate_with_driveline
 *
 * Description:
 *   This is the periodic task which controls the actions of the engine
 *   by defining mode of control and controlling speed and torque output
 *   levels depending upon the control function being performed. This task
 *   is also intended for control of other driveline components (not yet
 *   named) which may be available in the future.
 *****/

void communicate_with_driveline(void)
(
    initialize_driveline_data();

    x_start_periodic();
    while (1)
    (
        control_engine_compression_brake();

        determine_gos(); /* calculate (G)ear times the (O)utput (S)haft */

        determine_shiftability_variables();

        if (engine_communication_active)
        (
            if ((desired_sync_test_mode == TRUE) && (output_speed_filtered < 100))
                control_engine_sync_test_mode();

            else
            (
                /* start of normal engine_commands switch */

                switch (engine_commands)
                (
                    case ENGINE_PREDIP:
                        control_engine_predip();
                        break;

                    case ENGINE_SYNC:
                        control_engine_sync();
                        break;

                    case ENGINE_RECOVERY:
                        control_engine_recovery();
                        break;

                    case ENGINE_IDLE:
                        control_engine_idle();
                        break;

                    case ENGINE_START:
                        control_engine_start();
                        break;

                    case ENGINE_FOLLOWER:
                    default:
                        control_engine_follower();
                        break;
                )
            ) /* end of normal engine_commands switch */

            switch (eng_brake_command)
            (
                case ENG_BRAKE_OFF:
                    retarder_control = TORQUE_CONTROL;
                    desired_retarder_pct_trq = 0;
                    break;

                case ENG_BRAKE_FULL:
                    retarder_control = TORQUE_CONTROL;
                    desired_retarder_pct_trq = -100;
                    break;

                case ENG_BRAKE_IDLE:
                default:
                    retarder_control = OVERRIDE_DISABLED;

```

```
        desired_retarder_pct_trq = 0;
        break;
    }
    else
        engine_status = ENGINE_NOT_PRESENT;

    /* store old value for use in "control_engine_follower" function */
    accelerator_pedal_position_old = accelerator_pedal_position;

    x_sync_periodic(US_PER_LOOP);
}
x_end_periodic();
}
```

```

/*****
 *
 *      Unpublished and confidential. Not to be reproduced,
 *      disseminated, transferred or used without the prior
 *      written consent of Eaton Corporation.
 *
 *      Copyright Eaton Corporation, 1994
 *      All rights reserved.
 *
 *****/

 *
 * Filename: pr_s_i_s.c96      (AutoSplit)
 *
 * Description:
 * The modules contained within this compilation unit are
 * intended to implement functionality of the Process System
 * Input Signals task defined in the design documentation.
 * In general, Analog to digital conversions are started on
 * Port0. The necessary hardware initialization and variable
 * initialization for inputs on Port0 are handled. The switch
 * inputs are captured to avoid conflict with AD conversions
 * and all necessary scaling and error check for these inputs
 * is conducted.
 *
 * Part Number: <none>
 *
 * $Log:  ?
 *
 * Rev 1.1  19 May 1994 11:32:26  markyvech
 * Converted for use with AutoSplit ECU2
 *
 * Rev 1.0  12 Sep 1991 08:04:26  amsallen
 * Initial revision.
 *
 *****/

/*****
 *
 * Header files included.
 *
 *****/

#include <exec.h>           /* executive information          */
#include <kr_sfr.h>         /* KR special function registers */
#include <kr_def.h>         /* KR definitions                 */
#include <c_regs.h>         /* KR internal register definitions */
#include <wwslib.h>         /* world wide software definitions */
#include "pr_s_i_s.h"       /* process system input signal information */
#include "sysgen.h"         /* defines the task names and priority */

/*****
 *
 * #defines local to this file.
 *
 *****/

/* Start_AD_Conversions */

#define ENABLE_AD_PTS_SCAN 0X20
#define ENABLE_AD_ISR 0X20

#define PERIOD 10U          /* 10ms */
#define RKM_PERIOD 50U     /* 50ms */

/*****
 *
 * Constants and variables declared by this file.
 *
 *****/

/* Analog Inputs on Port0 */

int ignition_volts;
int splitter_position;

#define IGNITION_VOLTS_CHANNEL_RESULT 1

```

```

#define SPLITTER_POS_CHANNEL_RESULT    15

#define CONVERSION_TIME 0xef           /* for state time = 125 nsec: */
                                        /* sample time = 3.6250 usec */
                                        /* convert time = 20.1875 usec */
#define CONVERT_8 8                    /* scan and convert 8 channels */

#define CONVERT_IGNITION_VOLTS         (_NORM_MODE | 10_BIT_MODE | STRT_CONV | CHNL_0)
#define UNUSED_CHANNEL_1              (_NORM_MODE | 10_BIT_MODE | STRT_CONV | CHNL_1)
#define UNUSED_CHANNEL_2              (_NORM_MODE | 10_BIT_MODE | STRT_CONV | CHNL_2)
#define UNUSED_CHANNEL_3              (_NORM_MODE | 10_BIT_MODE | STRT_CONV | CHNL_3)
#define UNUSED_CHANNEL_4              (_NORM_MODE | 10_BIT_MODE | STRT_CONV | CHNL_4)
#define UNUSED_CHANNEL_5              (_NORM_MODE | 10_BIT_MODE | STRT_CONV | CHNL_5)
#define UNUSED_CHANNEL_6              (_NORM_MODE | 10_BIT_MODE | STRT_CONV | CHNL_6)
#define CONVERT_SPLITTER_POS          (_NORM_MODE | 10_BIT_MODE | STRT_CONV | CHNL_7)
#define STOP_CONVERSION                0x00
#define START_CONVERSIONS              _ad_command = CONVERT_IGNITION_VOLTS

/* table containing AD_result and AD_Command values after PTS scan */
unsigned int AD_Table[16];

/* AD SCAN PTS CONTROL BLOCK LOCATION */
_ad_ptsb_type AD_Con_Block;
#pragma locate(AD_Con_Block=0x01F8) /* locate pts control block */
#pragma pts(AD_Con_Block = 5)      /* set pts vector 5, A/D done */

#pragma eject

```



```

/*****
*
* Function: Initialize_Input_Signals
*
* Description:
*   This routine initializes the A/D converter. It sets the A/D to
*   run in PTS scan mode, 10bit conversion. The PTS control block is
*   set up and the Command/result table is initialized.
*
*****/

void Initialize_Input_Signals(void)
(
    /* if we knew when the first speed packet arrived, we could initialize
       with those values. since we don't, be safe and use zero. */

    AD_Table[0] = UNUSED_CHANNEL_1;      /* place holder for channel 1 */
    AD_Table[1] = 0x0000;                 /* IGNITION_VOLTS_CHANNEL_RESULT */
    AD_Table[2] = UNUSED_CHANNEL_2;      /* place holder for channel 2 */
    AD_Table[3] = 0x0000;                 /* UNUSED_1_RESULT */
    AD_Table[4] = UNUSED_CHANNEL_3;      /* place holder for channel 3 */
    AD_Table[5] = 0x0000;                 /* UNUSED_2_RESULT */
    AD_Table[6] = UNUSED_CHANNEL_4;      /* place holder for channel 4 */
    AD_Table[7] = 0x0000;                 /* UNUSED_3_RESULT */
    AD_Table[8] = UNUSED_CHANNEL_5;      /* place holder for channel 5 */
    AD_Table[9] = 0x0000;                 /* UNUSED_4_RESULT */
    AD_Table[10] = UNUSED_CHANNEL_6;     /* place holder for channel 6 */
    AD_Table[11] = 0x0000;                 /* UNUSED_5_RESULT */
    AD_Table[12] = CONVERT_SPLITTER_POS; /* Command convert splitter pos */
    AD_Table[13] = 0x0000;                 /* UNUSED_6_RESULT */
    AD_Table[14] = STOP_CONVERSION;      /* command to Stop conversions */
    AD_Table[15] = 0x0000;                 /* SPLITTER_POS_CHANNEL_RESULT */

    AD_Con_Block.cnt = CONVERT_8;
    AD_Con_Block.ctrl = _AD_MODE | _S_D_UPDT; /* A/D mode bits 0,1 of PTS_CONTROL */
                                              /* always set to 3h bit 2 = 0 */
                                              /* S/D update at end of cycle */
                                              /* bit 5 always 0 */
                                              /* Set mode for AD SCAN */

    AD_Con_Block.s_d = AD_Table;          /* Load s_d with AD_Table address */
    AD_Con_Block.reg = (void *)&_ad_result; /* Load reg with AD_Result address */

    _ad_time = CONVERSION_TIME;
    _ad_test = NO_OFFS;                   /* Disable test mode */
    _pts_select &= ~(PTS_ADDONE_BIT);     /* Disable AD PTS */
)

```

```

#pragma eject

```

```

/*****
 *
 * Function: AD_ISR
 *
 * Description:
 *   This interrupt service routine resets the PTSCOUNT, pts_sd and pts_reg
 *   for another PTS_Scan A/D cycle. It also readies a task to run when
 *   a PTS cycle has completed.
 *
 *****/

#pragma interrupt(AD_ISR=5)
void AD_ISR(void)
{
    x_start_isr();
    AD_Con_Block.cnt = CONVERT_8;          /* Reset pts count for next cycle */
    AD_Con_Block.s_d = AD_Table;          /* Reset table pointer to start of table */
    AD_Con_Block.reg = (void *)&_ad_result;

    x_ready(PROCESS_INPUT_SIGNALS);        /* Ready pr_s_i_s task */
    x_end_isr();
}

#pragma eject

```

```

/*****
*
* Function: Start_AD_Conversions
*
* Description:
*   This function initializes the input signal processing function
*   if it has not already been done, and then starts the PTS Scan
*   of the AD channels by sending the appropriate command to the
*   ad_command register.
*
*****/

void Start_AD_Conversions(void)
(
    if ((_int_mask & ENABLE_AD_ISR) == 0 )
        Initialize_Input_Signals();          /* Set up AD table for PTS */

    _pts_select |= ENABLE_AD_PTS_SCAN;
    _int_mask |= ENABLE_AD_ISR;

    x_pream_stimulus();

    START_CONVERSIONS; /* Start a conversion, initiate the PTS cycles */

    x_wait_stimulus(); /* AD_ISR will ready task when PTS is complete */
)

#pragma eject

```

```

/*****
 *
 * Function: process_input_signals
 *
 * Description:
 *   This is the periodic task which starts the analog conversions on Port0.
 *
 *****/

void process_input_signals(void)
{
    x_start_periodic();
    while (1)
    {
        Start_AD_Conversions();

        /* Clean up and scale AD values */
        ignition_volts = scale_system_ad_inputs(IGNITION_VOLTAGE);
        splitter_position = scale_system_ad_inputs(SPLITTER_POSITION);

        /* x_sync_periodic(PERIOD*1000); */
        x_sync_periodic(RKM_PERIOD*1000);
    }
    x_end_periodic();
}

#pragma eject

```

```

/*****
 *
 * Function:  scale_system_ad_inputs
 *
 * Description:
 *   This function removes the channel, status and reserved bits from
 *   the raw AD values, and performs all necessary scaling and error
 *   checking for the analog inputs on Port0.
 *
 *****/

```

```

int scale_system_ad_inputs(char Channel)
(
    int Scaled_Value = 0;
    uint volts_per_bit;    /* BIN 16 */
    uint units_per_bit;    /* BIN 16 */
    #define TWELVE_VOLT_FULL_SCALE    22.46 /* volts */
    #define TWENTY_FOUR_VOLT_FULL_SCALE 40.49 /* volts */
    #define DISTANCE_FULL_SCALE      100    /*      */

    volts_per_bit = (uint)((TWELVE_VOLT_FULL_SCALE*65536/1023)+0.5);
    units_per_bit = (uint)((DISTANCE_FULL_SCALE*65536/1023)+0.5);

    switch (Channel)
    (
    case 0: /* IGNITION VOLTAGE */
        _cx = AD_Table[IGNITION_VOLTS_CHANNEL_RESULT] >> 6;
        asm mulu _cxdx, volts_per_bit; /* volts, BIN 16 (_dx, BIN 0) */
        Scaled_Value = *(int *)&_dx;
        break;

    case 1: /* UNUSED */ /* to be completed when a product requires it */
        Scaled_Value = (0);
        break;

    case 2: /* UNUSED */ /* to be completed when a product requires it */
        Scaled_Value = (0);
        break;

    case 3: /* UNUSED */ /* to be completed when a product requires it */
        Scaled_Value = (0);
        break;

    case 4: /* UNUSED */ /* to be completed when a product requires it */
        Scaled_Value = (0);
        break;

    case 5: /* UNUSED */ /* to be completed when a product requires it */
        Scaled_Value = (0);
        break;

    case 6: /* UNUSED */ /* to be completed when a product requires it */
        Scaled_Value = (0);
        break;

    case 7: /* SPLITTER POSITION */
        _cx = AD_Table[SPLITTER_POS_CHANNEL_RESULT] >> 6;
        asm mulu _cxdx, units_per_bit; /* distance, BIN 16 (_dx, BIN 0) */
        Scaled_Value = *(int *)&_dx;
        break;

    default:
        break;
    )
    return (Scaled_Value);
)

```

```

/*****
*
*      Unpublished and confidential. Not to be reproduced,
*      disseminated, transferred or used without the prior
*      written consent of Eaton Corporation.
*
*      Copyright Eaton Corporation, 1993-94.
*      All rights reserved.
*
*****/

*
* Filename: sel_gear.c96      (AutoSplit)
*
* Description:
* This module is the periodic task "select_gear". It assigns values
* to destination_gear_selected as a function of selected_mode, input
* and output shaft speeds, and driver selections (dcc_manual_input).
* Shift parameters are in the data structure shf_tbl. Before setting
* destination_gear_selected, gears are checked with available_gear().
*
* Part Number: <none>
*
* $Log: R:\ashift\vecs\sel_gear.c9v $
*
* Rev 1.8  21 Feb 1994 15:07:14  schroeder
* Replaced shiftability_mode with new flag, engine_brake_available.
*
* Rev 1.0  29 Jul 1993 16:40:26  schroeder
* Initial revision.
*
*****/

/*****
*
* Header files included.
*
*****/

#include <exec.h>          /* executive information */
#include <c_regs.h>         /* c registers */
#include <wwslib.h>        /* contains common global defines */
#include "cont_sys.h"      /* control system */
#include "conj1939.h"      /* defines interface to j1939 control module */
#include "drl_cmds.h"      /* driveline commands information */
#include "sel_gear.h"       /* select gear */
#include "shf_tbl.h"        /* shift table definition */
#include "trn_tbl.h"        /* (system) transmission table definition */
#include "calc_spd.h"
#include "trns_act.h"
#pragma noreentrant

/*****
*
* #defines local to this file.
*
*****/

#define US_PER_LOOP 40000U

#define INITIAL_START_GEAR 1

/*****
*
* Constants and variables declared by this file.
*
*****/

/* public */

char destination_gear_selected;
char destination_gear;
char flash_desired_allowed;
char desired_gear;
char desired_gear_dn;      /* debug use - delete later */
char desired_gear_up;      /* debug use - delete later */
uchar coasting_latch;
uchar sel_gear_cntr1;      /* debug use - delete later */
uchar sel_gear_cntr2;      /* debug use - delete later */
uchar sel_gear_cntr3;      /* debug use - delete later */

```

```

uchar shift_init_type;
uint lpf_output_speed;
int dos_predicted;          /* BIN 0 */
int dos_prdtd_lim_no_jake;  /* BIN 0 */

/* local */

/* filter weights for the "mda" output speed filter */
static register uchar w1;
static register uchar w2;
static register uchar w3;
static register uchar w4;

/* shift table (define and extern in shf_tbl.h) */
struct shf_tbl_t shf_tbl;

/* default shift table values */
const struct shf_tbl_t ini_shf_tbl =
(
    1200,          /* aut_dwn_rpm */
    1000,          /* aut_min_dwn_rpm */
    1700,          /* aut_up_rpm */
    0,             /* best_gr_offset */
    50,            /* dwn_offset_rpm */
    100,           /* dwn_reset_rpm */
    400,           /* dwn_timer_offset_rpm */
    40,            /* hysteresis_rpm */
    1850,          /* man_dwn_sync_rpm */
    700,           /* man_up_sync_rpm */
    1900,          /* rated_rpm */
    150,           /* up_offset_rpm */
    125,           /* up_reset_rpm */
    200,           /* up_timer_offset_rpm */
    0,             /* dwn_accel */
    8,             /* up_accel */
    3000,          /* offset_time */
    (uint)(0.25*256), /* aut_up_pct */
    10,            /* min_output_spd */
    1,             /* max_start_gear */
    0,             /* padbyte1 */

    196,           /* k1_ability, min-ft/rev-sec, BIN 12 */
    431,           /* axle_ratio_cal, BIN 7 */
    383,           /* gcw_k1, rev/sec-min-ft, BIN 0 */
    2437,          /* gcw_k2, rev/sec^2, BIN 7 */
    1325,          /* calc_start_point, rpm, BIN 0 */

    107,           /* k6_ability, min-lb-ft-sec/rev, BIN 8 */
    1500,          /* auto_up_lo_base, rpm, BIN 0 */
    1100,          /* auto_dn_lo_base, rpm, BIN 0 */
    100,           /* auto_rtd_offset, rpm, BIN 0 */
    1000,          /* lowest_engage_rpm, BIN 0 */
    0,             /* padword1 */
    0,             /* padword2 */
);

/* local -- initialized at start of task by select_gear */

/* shift points with anti-hunt offsets; referenced by auto_downshift and
   auto_upshift; set by get_automatic_gear and select_gear */
uint upshift_point;
uint downshift_point;

/* lower limit for gear selections */
char lowest_forward;

/* indicate direction of a get_automatic_gear shift; referenced by
   get_manual_gear; cleared by select_gear when shift complete */
char automatic_sip;

/* used in the determination of shift_points based on throttle position */
static uint auto_up_rpm;
static uint auto_dn_rpm;
static uint auto_up_offset_rpm;
static uint auto_dn_offset_rpm;

/* delay counter for anti-hunt */
static uchar antihunt_counter;

```

/\* gross combined weight calculations \*/

```
#define ZERO_SPEED_TIME_LIMIT 4500 /* 3 min @ 0.040 period */
#define VALID_OLD_DATA_TIME 100 /* 4 sec @ 0.040 period */
#define MAX_VEHICLE_WEIGHT 100000 /* 100,000 lbs */
#define DOS_OFFSET_INIT 48
#define ENG_DECEL_LOW_LIMIT -350 /* rpm/s */
#define ENG_DECEL_LPF 224 /*  $\exp(-2\pi(0.53\text{Hz})(0.040\text{s})) = 0.875$  (BIN 8) */
```

#pragma eject



```

/*****
 *
 * Function: mda_output_filter
 *
 * Description:
 *   This is a one pole LPF with a variable coefficient. The magnitude
 *   of the coefficient is directly related to the acceleration content
 *   of the speed sample and the frequency.
 *
 *****/

static void mda_output_filter(void)
(
    #define K1 8
    #define K2 24
    #define K3 48
    #define K4 160

    static register uint os_delta_speed;
    static register uchar weight;

    if (lpf_output_speed > output_speed)
        os_delta_speed = lpf_output_speed - output_speed;
    else
        os_delta_speed = output_speed - lpf_output_speed;

    if (os_delta_speed <= K1)          /* delta <= 200 rpm/s */
    (
        if (w1 > 1) --w1;
        if (w2 < 5) ++w2;
        if (w3 < 6) ++w3;
        if (w4 < 7) ++w4;
        weight = w1;
    )
    else if (os_delta_speed <= K2)      /* 200 rpm/s < delta <= 600 rpm/s */
    (
        if (w1 < 4) ++w1;
        if (w2 > 2) --w2;
        if (w3 < 6) ++w3;
        if (w4 < 7) ++w4;
        weight = w2;
    )
    else if (os_delta_speed <= K3)      /* 600 rpm/s < delta <= 1200 rpm/s */
    (
        if (w1 < 4) ++w1;
        if (w2 < 5) ++w2;
        if (w3 > 3) --w3;
        if (w4 < 7) ++w4;
        weight = w3;
    )
    else if (os_delta_speed <= K4)      /* 1200 rpm/s < delta <= 4000 rpm/s */
    (
        if (w1 < 4) ++w1;
        if (w2 < 5) ++w2;
        if (w3 < 6) ++w3;
        if (w4 > 3) --w4;
        weight = w4;
    )
    else                                /* 4000 rpm/s < delta */
    (
        if (w1 < 4) ++w1;
        if (w2 < 5) ++w2;
        if (w3 < 6) ++w3;
        if (w4 < 7) ++w4;
        weight = 7;
    )

    lpf_output_speed = lpf_output_speed +
        (output_speed >> weight) - (lpf_output_speed >> weight);
)

#pragma eject

```

```

/*****
 *
 * Function: new_input_speed
 *
 * Description:
 *   A utility function that returns the input shaft speed expected if
 *   "gear" was engaged with the present output shaft speed.
 *
 *****/

static uint new_input_speed(char gear)
(
    /* new_input_speed = lpf_output_speed * gear_ratio */
    _ax = trn_tbl.gear_ratio[gear + GR_OFS];      /* BIN 8 */
    asm mulu _axbx, lpf_output_speed;             /* BIN 0+8=8 (_axbx) */
    asm shrl _axbx, #8;                            /* BIN 8>>=0 (_ax) */
    return _ax;
)

#pragma eject

```

```

/*****
 *
 * Function: auto_upshift
 *
 * Description:
 *   This boolean function returns true when automatic upshift
 *   conditions have been met.
 *
 *****/

```

```

static int auto_upshift(void)
{
    /* if (input_speed > upshift_point) */
    if ((gos > upshift_point) && (output_speed_filtered > 120))
    {
        if (engine_communication_active)
        {
            /* if ((lshiftability_hold) && (lshiftability_hold_II)) */
            sel_gear_cntr2++;
            return 1;
        }
    }
    return 0;
}

```

```

#pragma eject

```

```

/*****
 *
 * Function: auto_downshift
 *
 * Description:
 *   This boolean function returns true when automatic downshift
 *   conditions have been met.
 *
 *****/

```

```

static int auto_downshift(void)
{
  /* if (input_speed < downshift_point) */
  if (gos < downshift_point)
  {
    return 1;
  }
  return 0;
}
#pragma eject

```

```

/*****
 *
 * Function:  determine_autosplit_type
 *
 * Description:
 *   This function is used to determine if the impending shift type is
 *   MANUAL or AUTO.
 *
 *****/

```

```

static char determine_autosplit_type(char passed_new_gear, char passed_initial_gear)
(
    register char new_gr = passed_new_gear;
    register char init_gr = passed_initial_gear;

    if ((shift_in_process == FALSE) || (engine_status == ENGINE_RECOVERY_MODE))
    (
        if ((new_gr == 1 && init_gr == 2) || /* dn */
            (new_gr == 3 && init_gr == 4) || /* dn */
            (new_gr == 5 && init_gr == 6) || /* dn */
            (new_gr == 7 && init_gr == 8) || /* dn */
            (new_gr == 9 && init_gr == 10) || /* dn */
            (new_gr == 10 && init_gr == 9) || /* up */
            (new_gr == 8 && init_gr == 7) || /* up */
            (new_gr == 6 && init_gr == 5) || /* up */
            (new_gr == 4 && init_gr == 3) || /* up */
            (new_gr == 2 && init_gr == 1)) /* up */
            shift_init_type = AUTO;

        else
            shift_init_type = MANUAL;
    )

    if ((init_gr <= 4) && (new_gr < init_gr))
        shift_init_type = MANUAL; /* prevent coasting auto downshifts in low gears */
)

#pragma eject

```

```

/*****
 *
 * Function: get_automatic_gear
 *
 * Description:
 * This function returns an "automatic" forward gear selection. It
 * also performs driver requested shifts (manual_request) restricted
 * by shaft speeds. If no gears are available in required direction,
 * initial_gear is returned.
 *
 *****/

```

```

static char get_automatic_gear(char initial_gear, char manual_request)

```

```

(
    register char new_gear = initial_gear;

    if (automatic_sip != -1)
    (
        sel_gear_cntr3++;

        /* initiate or continue an automatic upshift: search up from lowest_forward
         (fastest input speed) for the first available gear that will provide input
         speed below a value (approx upshift rpm, minus an offset for gears that will
         result in a net downshift) */
        for (new_gear = lowest_forward;
            (new_input_speed(new_gear) > (upshift_point -
                (shf_tbl.up_offset_rpm + auto_dn_offset_rpm) : shf_tbl.best_gr_offset)))
            && (new_gear <= trn_tbl.highest_forward);
            ++new_gear;

        /* if we ran out of gears and the highest is available, it must be due to speed;
         pick highest_forward, input speed will be slower than it is now */
        if (new_gear > trn_tbl.highest_forward)
            new_gear = trn_tbl.highest_forward;

        desired_gear = new_gear;
        desired_gear_up = new_gear;
        determine_autosplit_type(new_gear, initial_gear);

        /* if in gear manual or the selection will underspeed, pick initial_gear */
        if (((shift_init_type == MANUAL) && (transmission_position == IN_GEAR)) ||
            ((automatic_sip == 0) && (new_gear <= initial_gear)))
            new_gear = initial_gear;
        else
        (
            /* indicate gear change and adjust downshift_point */
            automatic_sip = +1;
            auto_up_offset_rpm = 0;
            if (shift_init_type == AUTO)
                auto_dn_offset_rpm = shf_tbl.dwn_timer_offset_rpm;
            else
                auto_dn_offset_rpm = 0;
        )
    )

    if ((automatic_sip != 1) && (initial_gear > lowest_forward))
    (
        /* initiate or continue an automatic downshift: search down from
         highest_forward (slowest input speed) for the first available gear that will
         provide input speed above a value (approx downshift rpm, plus an offset for
         gears that will result in a net upshift) */
        for (new_gear = trn_tbl.highest_forward;
            (new_input_speed(new_gear) < (downshift_point +
                (new_gear > initial_gear ? shf_tbl.dwn_offset_rpm : shf_tbl.best_gr_offset)))
            && (new_gear >= lowest_forward);
            --new_gear;
            ;

        /* if we ran out of gears and the lowest is available, it must be due to speed;
         pick lowest_forward, input speed will be faster than it is now */
        if (new_gear < lowest_forward)
            new_gear = lowest_forward;

        desired_gear_dn = new_gear;

        if (desired_gear_dn < initial_gear) /* must be a down shift or else it */

```

also need  
 to indicate  
 upshift  
 +1

also need  
 to indicate  
 upshift  
 +1

save for  
 downshift  
 -1

```

    desired_gear = new_gear;          /* wrongly cancel the desired_up pick. */
    determine_autosplit_type(new_gear, initial_gear);

    /* if in gear manual or the selection will overspeed, pick initial_gear */
    if (((shift_init_type == MANUAL) && (transmission_position == IN_GEAR)) ||
        ((automatic_sip == 0) && (new_gear >= initial_gear)))
        new_gear = initial_gear;
    else
    {
        /* indicate automatic gear change and adjust upshift_point */
        automatic_sip = -1;
        auto_dn_offset_rpm = 0;
        if (shift_init_type == AUTO)
            auto_up_offset_rpm = shf_tbl.up_timer_offset_rpm;
        else
            auto_up_offset_rpm = 0;
    }
}
return new_gear;
}

#if (0)
**** This is the select gear based on AutoShift code ****
#pragma eject

```

```

/*****
 *
 * Function: get_automatic_gear
 *
 * Description:
 *   This function returns an "automatic" forward gear selection. It
 *   also performs driver requested shifts (manual_request) restricted
 *   by shaft speeds. If no gears are available in required direction,
 *   initial_gear is returned.
 *****/

static char get_automatic_gear(char initial_gear, char manual_request)
(
    register char new_gear = initial_gear;

    if (((automatic_sip == 0) && auto_upshift()) || (automatic_sip > 0))
    (
        sel_gear_cntr3++;

        /* initiate or continue an automatic upshift: search up from lowest_forward
         (fastest input speed) for the first available gear that will provide input
         speed below a value (approx upshift rpm, minus an offset for gears that will
         result in a net downshift) */
        for (new_gear = lowest_forward;
            (new_input_speed(new_gear) > (upshift_point -
                (new_gear < initial_gear ?
                    (shf_tbl.up_offset_rpm + auto_dn_offset_rpm) : shf_tbl.best_gr_offset)))
            && (new_gear <= trn_tbl.highest_forward);
            ++new_gear)
        ;

        /* if we ran out of gears and the highest is available, it must be due to speed;
         pick highest_forward, input speed will be slower than it is now */
        if (new_gear > trn_tbl.highest_forward)
            new_gear = trn_tbl.highest_forward;

        desired_gear = new_gear;
        determine_autosplit_type(new_gear, initial_gear);

        /* if in gear manual or the selection will underspeed, pick initial_gear */
        if ((shift_init_type == MANUAL) && (transmission_position == IN_GEAR))
            new_gear = initial_gear;
        else
        (
            /* indicate gear change and adjust downshift_point */
            automatic_sip = +1;
            auto_up_offset_rpm = 0;
            if (shift_init_type == AUTO)
                auto_dn_offset_rpm = shf_tbl.dwn_timer_offset_rpm;
            else
                auto_dn_offset_rpm = 0;
        )
    )
    else if (((automatic_sip == 0) &&
        (auto_downshift()) &&
        (initial_gear > lowest_forward)) ||
        (automatic_sip < 0))
    (
        /* initiate or continue an automatic downshift: search down from
         highest_forward (slowest input speed) for the first available gear that will
         provide input speed above a value (approx downshift rpm, plus an offset for
         gears that will result in a net upshift) */
        for (new_gear = trn_tbl.highest_forward;
            (new_input_speed(new_gear) < (downshift_point +
                (new_gear > initial_gear ? shf_tbl.dwn_offset_rpm : shf_tbl.best_gr_offset)))
            && (new_gear >= lowest_forward);
            --new_gear)
        ;

        /* if we ran out of gears and the lowest is available, it must be due to speed;
         pick lowest_forward, input speed will be faster than it is now */
        if (new_gear < lowest_forward)
            new_gear = lowest_forward;

        desired_gear = new_gear;
        determine_autosplit_type(new_gear, initial_gear);

        /* if in gear manual or the selection will overspeed, pick initial_gear */
    )
)

```



```

if ((shift_init_type == MANUAL) && (transmission_position == IN_GEAR))
    new_gear = initial_gear;
else
    (
        /* indicate automatic gear change and adjust upshift_point */
        automatic_sip = -1;
        auto_dn_offset_rpm = 0;
        if (shift_init_type == AUTO)
            auto_up_offset_rpm = shf_tbl.up_timer_offset_rpm;
        else
            auto_up_offset_rpm = 0;
    )
    return new_gear;
}

#endif

#pragma eject

```

```

/*****
*
* Function:  determine_destination
*
* Description:
*   This function uses "coasting_latch" to determine if a coasting or
*   skip shift is being attempted.  When sensed, the latch is used in
*   the determine_base_pts function to effect the base shift points.
*
*****/

```

```

void determine_destination(void)
(

```

```

    /* if coasting in neutral - force shift points */

```

```

    if (coasting_latch == FALSE)
    (

```

```

        if ((last_known_gear - destination_gear_selected) > 1) /* multi downshift */
        (

```

```

            if ((destination_gear_selected == 7) ||
                (destination_gear_selected == 5) ||
                (destination_gear_selected == 3) ||
                (destination_gear_selected == 1))
            (

```

```

                destination_gear_selected++;
                coasting_latch = TRUE;
            )
        )
    )

```

```

    else
    (

```

```

        if ((destination_gear_selected - last_known_gear) > 1) /* multi upshift */
        (

```

```

            if ((destination_gear_selected == 10) ||
                (destination_gear_selected == 8) ||
                (destination_gear_selected == 6) ||
                (destination_gear_selected == 4))
            (

```

```

                destination_gear_selected--;
                coasting_latch = TRUE;
            )
        )
    )

```

```

    else

```

```

        if (shift_in_process == FALSE)
            coasting_latch = FALSE;
    )

```

```

#pragma eject

```

```

/*****
*
* Function: determine_manual_shift_pts
* Description:
*
*****/

static void determine_manual_shift_pts(void)
{
    if (coasting_latch == FALSE)
    {
        if ((last_known_gear == 1) ||
            (last_known_gear == 3) ||
            (last_known_gear == 5) ||
            (last_known_gear == 7) ||
            (last_known_gear == 9))
            auto_dn_rpm = 1325;      /* manual downshifts */
        else
            auto_up_rpm = 1375;      /* manual upshifts */
    }
}

#pragma eject

```

```

/*****
 *
 * Function:  determine_base_auto_shift_pts
 *
 * Description:
 * This function determines the base up and down shift points based on
 * the position of the throttle. These base points will be used in the
 * calculation of the upshift_point and the downshift_point.
 *
 * The anti-hunting calculations have been moved to this function since
 * these calculations are now throttle dependent.
 *
 *****/

static void determine_base_auto_shift_pts(void)
(
    if (pct_demand_at_cur_sp > 0)
    (
        /* auto_up_rpm = shf_tbl.auto_up_lo_base +
           ((shf_tbl.aut_up_rpm - shf_tbl.auto_up_lo_base) * %throttle) */

        _cx = shf_tbl.aut_up_rpm - shf_tbl.auto_up_lo_base;
        _bx = pct_demand_at_cur_sp;
        asm mulu _cxdx, _bx;
        asm divu _cxdx, #100;
        auto_up_rpm = shf_tbl.auto_up_lo_base + _cx;

        /* check for RTD requirement */
        if (pct_demand_at_cur_sp > 90)
            auto_up_rpm += shf_tbl.auto_rtd_offset;

        /* auto_dn_rpm = shf_tbl.auto_dn_lo_base +
           ((shf_tbl.aut_dwn_rpm - shf_tbl.auto_dn_lo_base) * %throttle) */

        _cx = shf_tbl.aut_dwn_rpm - shf_tbl.auto_dn_lo_base;
        _bx = pct_demand_at_cur_sp;
        asm mulu _cxdx, _bx;
        asm divu _cxdx, #100;
        auto_dn_rpm = shf_tbl.auto_dn_lo_base + _cx;
    )
    else
    (
        auto_up_rpm = shf_tbl.auto_up_lo_base;
        auto_dn_rpm = shf_tbl.auto_dn_lo_base;
    )

    determine_manual_shift_pts();

    if (shift_in_process)
    (
        /* reset antihunt_counter */
        antihunt_counter = 0;

        /* allow the knob display to flashed any new desired gear */
        flash_desired_allowed = TRUE;
    )
    else
    (
        /* reset shift in process flags and update antihunt_counter */
        automatic_sip = 0;
        if (antihunt_counter < 255)
        (
            ++antihunt_counter;
        )
        /* flash_desired_allowed = FALSE; */

        /* look for upshift anti-hunt reset conditions */
        if ((antihunt_counter * (US_PER_LOOP/1000)) >= shf_tbl.offset_time)
        (
            /* check for last shift = upshift effects */
            if (auto_dn_offset_rpm == shf_tbl.dwn_timer_offset_rpm)
                auto_dn_offset_rpm = shf_tbl.dwn_offset_rpm;
            else if ((auto_dn_offset_rpm == shf_tbl.dwn_offset_rpm) &&
                (input_speed_filtered > auto_dn_rpm + shf_tbl.dwn_reset_rpm))
                auto_dn_offset_rpm = 0;

            /* check for last shift = downshift effects */
            if (auto_up_offset_rpm == shf_tbl.up_timer_offset_rpm)

```

```

    auto_up_offset_rpm = shf_tbl.up_offset_rpm;
else if ((auto_up_offset_rpm == shf_tbl.up_offset_rpm) &&
(input_speed_filtered > auto_up_rpm - shf_tbl.up_reset_rpm))
    auto_up_offset_rpm = 0;

/* allow the knob display to flashed the desired gear */
if (((desired_gear > destination_gear_selected) && (gos < (upshift_point + 25))) ||
((desired_gear < destination_gear_selected) && (gos > (downshift_point - 25))))
    flash_desired_allowed = FALSE;
else
    flash_desired_allowed = TRUE;

```

```

)

```

```

/* set the shift points based on throttle and determined offsets */
upshift_point = auto_up_rpm + auto_up_offset_rpm;
downshift_point = auto_dn_rpm - auto_dn_offset_rpm;

```

```

/* check that the calculated shift point is reasonable */
if (upshift_point > shf_tbl.man_dwn_sync_rpm)
    upshift_point = shf_tbl.man_dwn_sync_rpm;

```

```

if (downshift_point < shf_tbl.man_up_sync_rpm)
    downshift_point = shf_tbl.man_up_sync_rpm;

```

```

)

```

```

#pragma eject

```

```

/*****
 *
 * Function: select_gear
 *
 * Description:
 *   This is the root function for the periodic task SELECT_GEAR. Each
 *   loop begins by checking the manual up/down buttons. Then, based on
 *   selected_mode and output shaft speed, a 'get_..._gear' function is
 *   called to update destination_gear_selected.
 *
 *****/

void select_gear(void)
(
    char manual_request;          /* current manual request (+/- 1) */
    static uchar enable_gcw_calc; /* diagnostic - delete later !!*/

    enable_gcw_calc = FALSE;      /* diagnostic - delete later !!*/

    shf_tbl = ini_shf_tbl;        /* initialize the shift table */

    destination_gear_selected = 1;
    desired_gear = 1;

    /* initialize file scope variables */

    w1 = 3;
    w2 = 4;
    w3 = 5;
    w4 = 6;
    lpf_output_speed = output_speed;

    upshift_point = shf_tbl.aut_up_rpm;
    downshift_point = shf_tbl.aut_dwn_rpm;
    auto_up_offset_rpm = shf_tbl.up_timer_offset_rpm;
    auto_dn_offset_rpm = shf_tbl.dwn_timer_offset_rpm;
    lowest_forward = INITIAL_START_GEAR;
    automatic_sip = 0;
    antihunt_counter = 255U;
    coasting_latch = FALSE;
    flash_desired_allowed = TRUE;

    x_start_periodic();
    while (1)
    (
        mda_output_filter();      /* update our filtered output speed */
        manual_request = 0;
        determine_base_auto_shift_pts();

        /* set destination_gear_selected from function(s) appropriate for selected_mode */
        switch(selected_mode)
        (
            case REVERSE_MODE:

            case DRIVE_MODE:
                if ((forward_last == TRUE) && (low_speed_latch == FALSE))
                (
                    destination_gear_selected = get_automatic_gear(destination_gear_selected, manual_request);
                    determine_destination();
                    sel_gear_cntr1++; /* debug use only - delete later */
                )
                break;

            case LOW_MODE:
            case HOLD_MODE:
            case NEUTRAL_MODE:
            case PARK_MODE:
            case POWER_UP_MODE:
            case POWER_DOWN_MODE:
            case DIAGNOSTIC_TEST_MODE:
                /* prevent transient selection upon mode change (these modes ignore it) */
                destination_gear_selected = 0;
                break;

            default:
                /* invalid mode: do nothing */
                break;
        )
        x_sync_periodic(US_PER_LOOP);
    )
)

```

```
    }  
    x_end_periodic();  
}
```

```

/*****
 *
 *      Unpublished and confidential. Not to be reproduced,
 *      disseminated, transferred or used without the prior
 *      written consent of Eaton Corporation.
 *
 *      Copyright Eaton Corporation, 1991-94.
 *      All rights reserved.
 *
 *****/

 *
 * Filename: seq_shft.c96      (AutoSplit)
 *
 * Description:
 *   The functions in this file will perform the required system
 *   level operations for implementing Sequence Shift.
 *
 * Part Number: <none>
 *
 * $Log: R:\aselect\vc\seq_shft.c9v $
 *
 *   Rev 1.0   12 May 1994 16:26:00   markyvech
 *   Initial version
 *
 *****/

/*****
 *
 * Header files included.
 *
 *****/

#include <exec.h>      /* executive information */
#include <c_regs.h>     /* KR internal registers */
#include <wwslib.h>     /* World Wide Software Library */
#include "cont_sys.h"  /* control system information */
#include "conj1939.h"  /* Defines interface to engine communications info */
#include "con_o_s.h"   /* control output signal information */
#include "drl_cmds.h"  /* driveline commands information */
#include "sel_gear.h"
#include "shf_tbl.h"   /* Contains information relative to engine */
#include "trn_tbl.h"   /* transmission table information */
#include "trns_act.h"  /* transmission information */

/*****
 *
 * #defines local to this file.
 *
 *****/

/*****
 *
 * publics.
 *
 *****/

uchar sq_sh1; /* debug counter - delete later */
uchar sq_sh2; /* debug counter - delete later */
uchar sq_sh3; /* debug counter - delete later */

/*****
 *
 * Constants and variables declared by this file.
 *
 *****/

static uchar coast_mode; /* allows vehicle to coast in low gears */
static uint mode_time_out; /* time to disengage or synchronize a gear */

#pragma eject

```



1  
4

```
/******  
 *  
 * Function: initialize_sequence_shift  
 *  
 * Description:  
 *   This function initializes the variables to be used in sequence_shift.  
 *  
 *****/
```

```
void initialize_sequence_shift(void)  
{  
    shift_type = UPSHIFT;  
    shift_in_process = FALSE;  
}
```

```
#pragma eject
```

```

/*****
*
* Function: shift_initiate
*
* Description:
* This function begins the shift sequence by setting up the
* transmission to pull to Neutral, commands the electronic engine
* controller to go to zero torque and prepares the clutch to disengage
* if required.
*
*****/

static void shift_initiate(void)
(
    if (destination_gear < last_known_gear) /* determine shift type */
    (
        if (pct_demand_at_cur_sp > 5)
            shift_type = POWER_DOWN_SHIFT;
        else
            shift_type = COAST_DOWN_SHIFT;
    )
    else
        shift_type = UPSHIFT;

    /* Attempt to get out of gear for 3 seconds then return fuel to driver */
    /*
    if ( (engine_status != ENGINE_PREDIP_MODE) && (mode_time_out > 0) )
        mode_time_out = 300;
    if ( (mode_time_out > 0) && (!coast_mode) )
        --mode_time_out;
    */
    mode_time_out = 300; /* force value for now */

    /* initiate a normal shift sequence */

    /* (do not request engine fueling with engine brake on) */
    eng_brake_command = ENG_BRAKE_OFF; /* eng brake: zero torque */

    if ((lpf_output_speed < shf_tbl.min_output_spd) ||
        (clutch_state == DISENGAGED) ||
        (mode_time_out == 0) ||
        ((destination_gear < 4) &&
         (coast_mode) &&
         (accelerator_pedal_position <= 5) &&
         (shift_type != UPSHIFT)))
    (
        engine_commands = ENGINE_FOLLOWER;
    )
    else
    (
        engine_commands = ENGINE_PREDIP; /* engine: bring torque to zero */
        coast_mode = FALSE;
    )
)

#pragma eject

```

```

/*****
 *
 * Function: synchronize_gear
 *
 * Description:
 * This function assists the synchronizing of the transmission if
 * possible, by controlling input shaft speed through the use
 * of the clutch, power synchronizer, or inertia brake. It will
 * offset sync windows if the shift is taking longer than expected.
 * It will assist with engagement at rest if the clutch is dragging.
 *
 *****/

static void synchronize_gear(void)
(
    /* turn on engine brakes (J1939) if engine brake assisted shift is requested */

    if (eng_brake_assist)
        eng_brake_command = ENG_BRAKE_FULL;
    else
        eng_brake_command = ENG_BRAKE_OFF;

    /* Attempt to engage for 6 seconds then return fuel control to the driver */
    /*
    if ( (engine_status != ENGINE_SYNC_MODE) && (mode_time_out > 0) )
        mode_time_out = 600;
    if ( (mode_time_out > 0) && (!coast_mode) )
        --mode_time_out;
    */
    mode_time_out = 600; /* force value for now */

    if ((lpf_output_speed < shf_tbl.min_output_spd) ||
        (clutch_state == DISENGAGED) ||
        (mode_time_out == 0) ||
        ((destination_gear < 4) &&
         (coast_mode) &&
         (accelerator_pedal_position <= 5) &&
         (shift_type != UPSHIFT)))
    {
        engine_commands = ENGINE_FOLLOWER;
    }

    else
    {
        engine_commands = ENGINE_SYNC;
        coast_mode = FALSE;
    }
}

#pragma eject

```

```

/*****
 *
 * Function: confirm_shift
 *
 * Description:
 *   This function finished the shift; shift_in_process is set FALSE.
 *
 *****/

static void confirm_shift(void)
(
    engine_commands = ENGINE_RECOVERY;    /* engine: finish torque return */
    eng_brake_command = ENG_BRAKE_OFF;    /* eng brake: zero torque */
    mode_time_out = 300;                  /* reset for next shift */
    shift_in_process = FALSE;
    coast_mode = TRUE;
)

#pragma eject

```

```

/*****
 *
 * Function:  sequence_shift
 *
 * Description:
 * This function calls the appropriate procedures to perform the
 * operations of Sequence_Shift depending on the correct state of
 * the shift process.
 *
 *****/

void sequence_shift(void)
(
    if (destination_gear == NULL_GEAR) /* system has reset: do not start a shift */
    (
        engine_commands = ENGINE_FOLLOWER;
        eng_brake_command = ENG_BRAKE_IDLE;
    )

    else
        if (((transmission_position == OUT_OF_GEAR) &&
            ((engine_status == ENGINE_SYNC_MODE) ||
            (engine_status == ENGINE_PREDIP_MODE))) /* forces call shift_initiate() */
        (
            sq_sh1++;
            synchronize_gear();
        )

        else
            if (((engine_status == ENGINE_SYNC_MODE) ||
                (engine_status == ENGINE_RECOVERY_MODE)) &&
                (destination_gear == current_gear) &&
                (transmission_position == IN_GEAR))
            (
                sq_sh2++;
                confirm_shift();
            )

            else
                if (((destination_gear != current_gear) && /* auto splitter */
                    (low_speed_latch == FALSE) &&
                    (automatic_sip != 0) &&
                    (transmission_position == IN_GEAR)) ||
                    ((transmission_position == OUT_OF_GEAR) && /* manual shift */
                    (low_speed_latch == FALSE)))
                (
                    shift_initiate();
                    sq_sh3++;
                )
)

```

```

/*****
 *
 *      Unpublished and confidential. Not to be reproduced,
 *      disseminated, transferred or used without the prior
 *      written consent of Eaton Corporation.
 *
 *      Copyright Eaton Corporation, 1994.
 *      All rights reserved.
 *
 *****/

 *
 * Filename:  trns_act.c96      (AutoSplit)
 *
 * Description:
 * This modules monitors and controls the transmission actions.
 *
 * Part Number:  <none>
 *
 * $Log:   ??? $
 *
 * Rev 1.0  3 May 1994 13:35:04  markyvech
 * Initial revision.
 *
 *****/
/*****
 *
 * Header files included.
 *
 *****/

#include <exec.h>          /* executive information */
#include <c_regs.h>         /* KR internal register definitions */
#include <kr_sfr.h>        /* defines the kr special function registers */
#include <kr_def.h>        /* 80c196kr bits, constants, and structures */
#include <wwslib.h>
#include "drl_cmds.h"      /* engine control interface */
#include "trns_act.h"      /* interface to this module */
#include "trn_tbl.h"       /* transmission table */
#include "calc_spd.h"
#include "cont_sys.h"
#include "sel_gear.h"
#include "conj1939.h"

/*****
 *
 * Variables declared by this file.
 *
 *****/

register unsigned char  transmission_position;

unsigned char  low_speed_latch;
unsigned char  forward_last;
unsigned char  splitter_hi;
unsigned char  splitter_lo;
unsigned char  splitter_timer;
unsigned char  splitter_within_sync;
unsigned char  aux_box;
signed char   g_ptr_old;
signed char   current_gear;
signed char   last_known_gear;
unsigned int  gear_in_timer;
unsigned int  gear_out_timer;
unsigned int  abs_trans_sync_error;
unsigned int  trans_window_calc;
signed int   input_speed_modified;
signed int   trans_sync_error;
signed int   range_error;
signed int   range_cal;
signed int   splitter_tc;

signed long   isdgm;
signed long   gros;
signed char   g_ptr;

#pragma eject

```

```

/*****
*
* #defines and constants local to this file.
*
*****/

```

```

#define US_PER_LOOP 10000U
#define RKM_US_PER_LOOP 40000U

```

```

static const uchar SPLITTER_LO_TABLE[23] =
(
    0,      /* -4 */
    0,      /* -3 */
    ON,     /* -2 */ /* split_lo = OFF, split_hi = ON; overdrive */
    ON,     /* -1 */ /* split_lo = ON, split_hi = OFF; direct */
    ON,     /* 0 */ /* split_lo = ON, split_hi = OFF; direct */
    ON,     /* 1 */ /* split_lo = ON, split_hi = OFF; direct */
    ON,     /* 2 */ /* split_lo = OFF, split_hi = ON; overdrive */
    ON,     /* 3 */ /* split_lo = ON, split_hi = OFF; direct */
    ON,     /* 4 */ /* split_lo = OFF, split_hi = ON; overdrive */
    ON,     /* 5 */ /* split_lo = ON, split_hi = OFF; direct */
    ON,     /* 6 */ /* split_lo = OFF, split_hi = ON; overdrive */
    ON,     /* 7 */ /* split_lo = ON, split_hi = OFF; direct */
    ON,     /* 8 */ /* split_lo = OFF, split_hi = ON; overdrive */
    ON,     /* 9 */ /* split_lo = ON, split_hi = OFF; direct */
    ON,     /* 10 */ /* split_lo = OFF, split_hi = ON; overdrive */
    0,      /* 11 */
    0,      /* 12 */
    0,      /* 13 */
    0,      /* 14 */
    0,      /* 15 */
    0,      /* 16 */
    0,      /* 17 */
    0       /* 18 */
);

```

```

static const uchar SPLITTER_HI_TABLE[23] =
(
    0,      /* -4 */
    0,      /* -3 */
    ON,     /* -2 */ /* split_lo = OFF, split_hi = ON; overdrive */
    OFF,    /* -1 */ /* split_lo = ON, split_hi = OFF; direct */
    OFF,    /* 0 */ /* split_lo = ON, split_hi = OFF; direct */
    OFF,    /* 1 */ /* split_lo = ON, split_hi = OFF; direct */
    ON,     /* 2 */ /* split_lo = OFF, split_hi = ON; overdrive */
    OFF,    /* 3 */ /* split_lo = ON, split_hi = OFF; direct */
    ON,     /* 4 */ /* split_lo = OFF, split_hi = ON; overdrive */
    OFF,    /* 5 */ /* split_lo = ON, split_hi = OFF; direct */
    ON,     /* 6 */ /* split_lo = OFF, split_hi = ON; overdrive */
    OFF,    /* 7 */ /* split_lo = ON, split_hi = OFF; direct */
    ON,     /* 8 */ /* split_lo = OFF, split_hi = ON; overdrive */
    OFF,    /* 9 */ /* split_lo = ON, split_hi = OFF; direct */
    ON,     /* 10 */ /* split_lo = OFF, split_hi = ON; overdrive */
    0,      /* 11 */
    0,      /* 12 */
    0,      /* 13 */
    0,      /* 14 */
    0,      /* 15 */
    0,      /* 16 */
    0,      /* 17 */
    0       /* 18 */
);

```

```

#pragma eject

```

```

static const uchar SPLITTER_TC_TABLE[23] =
(
    0,      /* -4 */
    0,      /* -3 */
    100,    /* -2 */ /* splitter = overdrive */
    100,    /* -1 */ /* splitter = direct */
    100,    /* 0 */ /* splitter = direct */
    100,    /* 1 */ /* splitter = direct */
    100,    /* 2 */ /* splitter = overdrive */
    100,    /* 3 */ /* splitter = direct */
    100,    /* 4 */ /* splitter = overdrive */
    100,    /* 5 */ /* splitter = direct */
    100,    /* 6 */ /* splitter = overdrive */
    100,    /* 7 */ /* splitter = direct */
    100,    /* 8 */ /* splitter = overdrive */
    100,    /* 9 */ /* splitter = direct */
    100,    /* 10 */ /* splitter = overdrive */
    0,      /* 11 */
    0,      /* 12 */
    0,      /* 13 */
    0,      /* 14 */
    0,      /* 15 */
    0,      /* 16 */
    0,      /* 17 */
    0,      /* 18 */
);

#pragma eject

```



```

/*****
*
* Function: Initialize_Trans_Action
*
* Description:
*   This function initializes those module variables that must be set to a
*   know state on power up or reset.
*
*****/

```

```

void initialize_trans_action(void)
{
    gear_in_timer = 200;
    gear_out_timer = 200;
    g_ptr_old = 0;
    current_gear = 0;
    last_known_gear = 0;
    destination_gear = 0;
    transmission_position = OUT_OF_GEAR;
    low_speed_latch = TRUE;
    splitter_lo = 0;
    splitter_hi = 0;

```

```

}

```

```

#pragma eject

```

```

/*****
 *
 * Function: determine_gear
 *
 * Description:
 * This function determines the current gear that the transmission
 * is in. When conditions are such that the current gear can not be
 * determined it will be set to a default,(0).
 *
 * Note: When the error across the transmission is near zero for some
 * time for a given test gear then it will be deemed in that gear.
 *
 *      error = input_spd/gf[gear] - gr[gear] * os
 *
 *****/
void determine_gear(void)
(
#define BIN_8          256      /* 2 BIN 8 */
#define MAX_ERR        4000    /* RPM */
#define WINDOW         30      /* 30 RPM */
#define GEAR_IN_TIME_LEVER 30   /* 300 MSEC */
#define GEAR_IN_TIME_AUTO 20   /* 200 MSEC */
#define GEAR_OUT_TIME   8      /* 80 MSEC */
#define ERROR_FUDGE_FACTOR 3    /* RPM */
/*
signed long   isdgf;
signed long   gros;
signed char   g_ptr;
*/

#if (0)
    g_ptr = -1; /* lowest reverse ratio */

/*   isdgf = (((signed long) input_speed_filtered) * BIN_8) / trn_tbl.GF[g_ptr + GR_OFS]; */
    _bx = (signed int)(input_speed_filtered);
    _cx = BIN_8;
    _ax = trn_tbl.GF[g_ptr + GR_OFS];
    asm mul _cxdx, _bx;
    asm div _cxdx, _ax;
    isdgf = _cx;

/*   gros = (((signed long) output_speed_filtered) * trn_tbl.GR[g_ptr + GR_OFS]) / BIN_12; */
    _bx = (signed int)(output_speed_filtered + ERROR_FUDGE_FACTOR);
    _cx = trn_tbl.GR[g_ptr + GR_OFS];
    _ax = BIN_8;
    asm mul _cxdx, _bx;
    asm div _cxdx, _ax;
    gros = _cx;

    trans_sync_error = (isdgf - gros);
    if (isdgf > gros)
        abs_trans_sync_error = (unsigned int)(isdgf - gros);
    else
        abs_trans_sync_error = (unsigned int)(gros - isdgf);
#endif

    abs_trans_sync_error = MAX_ERR;
    trans_window_calc = 0;

    if (abs_trans_sync_error > trans_window_calc) /* if not in reverse, check for forward */
    (
        g_ptr = 1 + trn_tbl.highest_forward;
        abs_trans_sync_error = MAX_ERR;
        while ((abs_trans_sync_error > trans_window_calc) && (g_ptr != 0))
        (
            g_ptr--;
            /*   isdgf = (((signed long) input_speed_filtered) * BIN_8) / trn_tbl.GF[g_ptr + GR_OFS]; */
            _bx = (signed int)(input_speed_filtered);
            _cx = BIN_8;
            _ax = trn_tbl.GF[g_ptr + GR_OFS];
            asm mul _cxdx, _bx;
            asm div _cxdx, _ax;
            isdgf = _cx;

            /*   gros = (((signed long) output_speed_filtered) * trn_tbl.GR[g_ptr + GR_OFS]) / BIN_12; */
            _bx = (signed int)(output_speed_filtered + ERROR_FUDGE_FACTOR);
            _cx = trn_tbl.GR[g_ptr + GR_OFS];

```

```

_ax = BIN_8;
asm mul _cxdx, _bx;
asm div _cxdx, _ax;
gros = _cx;

trans_sync_error = isdgf - gros;
if (isdgf > gros)
    abs_trans_sync_error = (int)(isdgf - gros);
else
    abs_trans_sync_error = (int)(gros - isdgf);

/* calculate trans sync error window based on gear pointer */
_bx = WINDOW; /* BIN 0 */
_cx = BIN_8; /* BIN 8 */
_ax = trn_tbl.GF[g_ptr + GR_OFS]; /* BIN 8 */
asm mulu _cxdx, _bx; /* make WINDOW BIN 8 */
asm divu _cxdx, _ax; /* divide by front ration BIN 8 */
trans_window_calc = _cx; /* BIN 0 */
)
)

if (g_ptr == 0) /* If in neutral, force values */
(
    abs_trans_sync_error = MAX_ERR;
    trans_sync_error = MAX_ERR;
    trans_window_calc = 0;
    isdgf = 0;
    gros = 0;
)

if ((abs_trans_sync_error > trans_window_calc) || /* Must have error for some */
    ((g_ptr != current_gear) && (current_gear != 0))) /* before neutral state is */
( /* recognized. */
    if (gear_out_timer == 0)
    (
        transmission_position = OUT_OF_GEAR;
        current_gear = 0;
    )

    else
        gear_out_timer--;
)
else
    gear_out_timer = GEAR_OUT_TIME;

if ((g_ptr != g_ptr_old) || (g_ptr == 0) || /* if not in gear, init gear in timer. */
    ((accelerator_pedal_position < 5) && /* Rule out picking a gear when coasting */
    (input_speed < 800) && /* down in neutral and no throttle. */
    (low_speed_latch == FALSE))) /* (Found that idle speed and output speed */
/* would natch a gear even when in neutral.) */
(
    if ((engine_commands == ENGINE_SYNC) ||
        (engine_commands == ENGINE_PREDIP))
    (
        if (shift_init_type == AUTO)
            gear_in_timer = GEAR_IN_TIME_AUTO;
        else
            gear_in_timer = GEAR_IN_TIME_LEVER;
    )
)

else
    if (gear_in_timer == 0)
    (
        current_gear = g_ptr;
        last_known_gear = g_ptr;
        transmission_position = IN_GEAR;

        if ((gros_current_gear > (downshift_point + 100)) &&
            (low_speed_latch == TRUE))
        (
            low_speed_latch = FALSE;
            destination_gear = current_gear;
            destination_gear_selected = current_gear;
            desired_gear = current_gear;
            lowest_forward = current_gear;
        )
        else
        (

```

```

    if (low_speed_latch == TRUE)
    (
        destination_gear = lowest_forward; /* was set to 1 */
        destination_gear_selected = lowest_forward; /* was set to 1 */
        desired_gear = lowest_forward; /* was set to 1 */
        shift_in_process = FALSE;
    )
)

if (last_known_gear > 0) /* Record REV/FOR data for */
    forward_last = TRUE; /* use in the select_gear */
else /* module. */
    forward_last = FALSE;
)
else
    gear_in_timer--;

g_ptr_old = g_ptr ;

if (output_speed_filtered < 80) /* If stopped - current_gear = first. */
(
    current_gear = 0 ;
    transmission_position = OUT_OF_GEAR;
    low_speed_latch = TRUE;
)
)

#pragma eject

```

```

/*****
 *
 * Function:  determine_range_status
 *
 * Description:
 * This function determines the status the of range.
 *
 *  $rng\_err = rear\_counter\_spd - (range\_ratio * output\_spd)$ 
 *
 *  $r_{cs} = 54/21 * 44 * os$  (for low range)
 *
 *  $r_{cs} = 42/51 * 44 * os$  (for high range)
 *
 *****/

void determine_range_status(void)
(
#define BIN_12          4096  /* 2 bin 12 */
#define HI_RANGE_GEAR    7
#define LO_RANGE_CAL     10532 /* 54/21 BIN 12 */
#define HI_RANGE_CAL     3373  /* 42/51 BIN 12 */
#define RANGE_WINDOW_POS  30   /* 30 RPM */
#define RANGE_WINDOW_NEG -30   /* -30 RPM */

    if (destination_gear >= HI_RANGE_GEAR)
        range_cal = HI_RANGE_CAL;
    else
        range_cal = LO_RANGE_CAL;

    range_error = (((aux_speed * BIN_12)
                    - (range_cal * output_speed_filtered))/BIN_12);

    if ((range_error > RANGE_WINDOW_POS) || (range_error < RANGE_WINDOW_NEG))
        aux_box = OUT_OF_GEAR;
    else
        aux_box = IN_GEAR;
)

#pragma eject

```

```

/*****
 *
 * Function: determine_splitter
 *
 * Description:
 * This function determines the correct state for the splitter.
 * Once the transmission is in gear both splitter solenoids are turned off.
 *
 *****/

```

```

void determine_splitter_state(void)

```

```

(
#define SPLTR_SYNC_OFFSET_POS    80    /* 80 RPM */
#define SPLTR_SYNC_OFFSET_NEG   -80    /* -80 RPM */
#define SPLITTER_TIME           20    /* 200 MSEC */

    if (engine_status == ENGINE_PREDIP_MODE)
        splitter_timer = SPLITTER_TIME;
    else
        if (splitter_timer > 0)
            splitter_timer--;

    splitter_tc = SPLITTER_TC_TABLE[destination_gear + GR_OFS];

    input_speed_modified = (signed int)(input_speed_filtered) +
        (input_speed_accel_filtered/(1000/splitter_tc));

    if ((input_speed_modified < (gos_signed + SPLTR_SYNC_OFFSET_POS)) &&
        (input_speed_modified > (gos_signed + SPLTR_SYNC_OFFSET_NEG)))
        splitter_within_sync = TRUE;
    else
        splitter_within_sync = FALSE;

    if ((splitter_timer > 0) ||
        ((transmission_position == IN_GEAR) &&
         (shift_in_process == FALSE)) || /* debug - delete later */
        (low_speed_latch == TRUE) ||
        (engine_status == ENGINE_RECOVERY_MODE) ||
        ((shift_init_type == MANUAL) &&
         (engine_status == ENGINE_SYNC_MODE)) ||
        ((shift_init_type == AUTO) &&
         (engine_status == ENGINE_SYNC_MODE) &&
         (splitter_within_sync == TRUE)))
    (
        splitter_hi = SPLITTER_HI_TABLE[destination_gear + GR_OFS];
        splitter_lo = SPLITTER_LO_TABLE[destination_gear + GR_OFS];
    )
    else
    (
        splitter_hi = OFF;
        splitter_lo = OFF;
    )
)

#pragma eject

```

```

/*****
*
* Function: Transmission_Action
*
* Description:
*   This function controls the states of the system output devices.
*
*****/
void transmission_action(void)
{
    initialize_trans_action();    /* initialize variables */

    x_start_periodic();
    while (1)
    {
        determine_gear();          /* calculate the current gear */
        determine_range_status(); /* determine range state */
        determine_splitter_state(); /* determine correct state for splitter */

        x_sync_periodic(US_PER_LOOP);
    }
    x_end_periodic();
}

```

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**